

AD-A203 975

PROGRAM *manager*

DTIC FILE COPY

DTIC
CTE
JAN 03 1989

Simpler Systems

Journal of the Defense Systems Management College

This document has been approved
for public release and sale; its
distribution is unlimited.

88 12 20 001

PROGRAM manager

Journal of the Defense

DEFENSE SYSTEMS MANAGEMENT COLLEGE

Commandant
Major General Lynn H. Stevens,
USA

Provost
Gregory T. Wierzbicki

*Dean, Department of
Research and Information*
Captain Ralph W. Ortengren, Jr.,
USN

Director of Publications
Robert W. Ball



PROGRAM MANAGER

Managing Editor
Catherine M. Clark

Associate Editor
Esther M. Farria

Editorial Assistant
Janet A. English

Art Director
Greg Caruth

Designer/Illustrator
Janet R. M. Fitzgerald

Photographer
James Pleasants

Program Manager (ISSN 0199-7114)
is published bimonthly by the Defense
Systems Management College, Fort
Belvoir, VA 22060-5426. Non-govern-
ment employees and organizations may
subscribe at \$7.50 annually through the
Superintendent of Documents, U.S.
Government Printing Office,
Washington, D.C. 20402. Second class
postage paid at Fort Belvoir, VA.

POSTMASTER: Send address
changes to *Program Manager*, Defense
Systems Management College, Fort
Belvoir, VA 22060-5426.

2

Manpower Estimate Reports: Implications and Relationships

Dr. Robert Boynton

Congressional legislation
requires the Department of
Defense to provide Man-
power Estimate Reports
before full-scale development
and production of a major
weapon system. The author
examines industry and the
military services regarding
this requirement.

7

The DuPont Model and The Experience Effect as Tools of Strategic Management

Dr. Fred Waelchli
Mr. David Westermann

How to understand and
evaluate data on the financial
health of defense contractors
and the defense industry as a
whole.

14

Making Smart Logistics Managers

Mr. Michael E. Harris

How to have the right sup-
port resources available in
the right places at the right
times.

19

Largest DSMC Correspondence Class Is An Outstanding Success

The DSMC Commandant
travels to West Virginia to
present diplomas to 178
people for completing the
Contractor Performance
Measurement Course.

20

Ethics: Can We Get a Grip on Ourselves? Do Adequate Constraints Exist to Deter Defense Acquisition People from Violating the Code?

Mr. Wilbur D. Jones, Jr.

Are you observing the
rules? Mr. Jones lists them.

32

International NCO Panel at DSMC is Well Received

James E. Hoffman,
RMCM, USN
Larry J. Dyer,
RMCS, USN

In keeping with the DSMC
commitment to stay in touch
with the user, the Senior
Enlisted Panel addresses
issues for present and future
program managers from a
customer's viewpoint.

S y s t e m s M a n a g e m e n t C o l l e g e

34

Producibility Practices

Mr. Robert Rathe
Mr. David Acker

A look at technical and managerial problems associated with the implementation of government policy.

Also

Letters to the Editor 6

Inside DSMC 43

Send Us Your Articles **Inside Back Cover**

44

**Live Fire Testing:
Planning Implications
For Acquisition Process**

Colonel Larry R. Stanford, USA

Costly and highly visible Live Fire Testing should have well-managed and well-executed programs.

47

**Government/Industry:
Teaming for Success**

Virginia A. Lentz

A report of the DSMC annual Alumni meeting.

Accession For	
NTIS GRA&I	<input checked="" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
# 2.30	
By	GPO
Distribution/	
Availability Codes	
Dist	Avail and/or Special
A-1	24



For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C. 20402

Program Manager is intended to be a vehicle for the transmission of information on policies, trends, events, and current thinking affecting program management and defense systems acquisition.

Statements of fact or opinion appearing in *Program Manager* are solely those of the authors and are not necessarily endorsed by the Department of Defense or the Defense Systems Management College. Unless copyrighted, articles may be reprinted. When reprinting, please credit the author and *Program Manager*, and forward two copies of the reprinted material to the Director of Publications.

To subscribe, government personnel should submit written requests (using their business addresses) to the Director of Publications.

Manuscripts and other correspondence are welcome and should be addressed to the Director of Publications. Inquiries concerning proposed articles may be made by phone at (703) 664-5082 -5971 or AUTOVON 354-5082 -5974.

MANPOWER ESTIMATE REPORTS: IMPLICATIONS AND RELATIONSHIPS

Dr. Robert Boynton



This prototype turbine engine requires only one wrench to restore any field replaceable part.

Recently, the Congress enacted legislation requiring the Department of Defense to provide Manpower Estimate Reports to the Congress before full-scale development and production of a major weapon system. This paper examines some long-term implications of this requirement for the relationships between industry and the military services.

In the past, the Congress preferred that industry and the military services maintain an "arm's length" relationship so that contractors do not unduly influence the Services. Weapon and cost problems and accusations of blame have turned this arm's-length relationship into an antagonistic one. The Packard Commission called attention to the troubled relationship between the defense industry and government. Its report states "...ways must be found to restore a sense of shared purpose and mutual confidence among Congress, DOD, and industry. Each must forsake its current ways of doing business in favor of a renewed quest for excellence."¹ In this paper, we see that a mutual partnership relationship is desirable and absolutely essential if requirements for information, design, and operation implied in the new concern about manpower are to be realized. It appears that industry and the Department of Defense are entering an era where openness and close collaboration will replace suspicion and antagonism as the business mode.

Background

The media headlined cost overruns and \$50 hammers, but some members of the Congress are concerned about the lack of attention paid to human-resource implications as new weapon systems are developed and fielded. Development of high-technology weapon systems seems to outpace the ability of the Service men and women to operate and maintain them.

In the dust and confusion of battle, is it realistic to ask a young soldier to go through a 12-step procedure to fire a weapon? As increased reliance is placed on the Reserves, can we permit a system to be so complex that the soldier loses 50 percent accuracy and skill if not *regularly* practicing with a particular weapon in the preceding 3 months? With fewer young people, can the military services enlist and retain enough of the brightest ones to maintain complex weapons? Can we afford to spend more resources in training for specific weapon systems? Can we afford weapons requiring so much maintenance that only 50 percent are fully operational?

Such concerns resulted in a *new* manpower report requirement by the Congress. "The Secretary of Defense may not

The DOD
recognizes underlying
problems can be
addressed only if
manpower, personnel,
training and safety
receive full
consideration
long before
congressional
reports are
filed.



approve the full-scale engineering development, or the production and deployment, of a major defense acquisition program unless...the Secretary submits a manpower estimate of the program to the Committees on Armed Services of the Senate and the House of Representatives at least 90 days in advance of such approval."² Providing manpower-estimate reports to the Congress appears to be a simple matter. The report is to contain three estimates.

—First, the number of personnel and man-years required to operate, maintain, support, and train for the system on full deployment. This will involve stating assumptions regarding total buy of weapons and deployment and operating schedules, and estimating total man-years and end-strength for military, civilian, and contractor personnel in the operator, maintenance, support, and training categories. The report thus accounts for the total number of military, civilian and contractor personnel expected to be required to operate, maintain, and support the program and to train those personnel until the system is fully deployed.

—Second, the report must estimate any increase in total military and civilian end-strengths that will be required for full operational deployment.

—Third, the report must estimate how the system will be operationally deployed if that increase in end-strengths is not authorized by the Congress.

The Department of Defense recognizes underlying problems can be addressed only if manpower, personnel, training and safety (MPTS) receive full consideration long before congressional reports are filed. There will be little opportunity for trade-offs or adjustment of operational and readiness impacts by that time because about 80 percent of manpower requirements will have been fixed by decisions in the earlier concept development phase (Milestone 0) of the program. About 90 percent of manpower requirements are set by the beginning of engineering development (Milestone I). Congressional Manpower Estimate Reports are required only at full-scale development (Milestone II) and production and deployment (Milestone III) decision points in the defense acquisition process. At these later points in the program, changes would entail great expenses and significant delays for redesign and modification.

To avoid these problems, manpower and personnel and training and safety concerns must permeate the entire acquisition process. Earliest stages of the process are most critical, since early consideration of manpower information allows for cheaper and simpler accommodation to trade-offs and other concerns. It is, however, the early periods where most uncertainty attaches to decisions, where ability to clearly specify effects is weakest, and where manpower-prediction tools are most in need of development.

Since the Department of Defense has not issued implementing rules for addressing this new concern for human resources in weapon systems, exact requirements are unclear; however, general outlines and major implications can be discerned from the Defense Secretary's 1989 *Annual Report*. "Just as weapon systems designs are subjected to rigorous life-cycle analyses, requirements for manpower resources must be examined early enough in the acquisition cycle to ensure that proposed man-machine systems are structured in the most cost-effective manner possible. We are strengthening our ability to assess total manpower, personnel, training, and safety (MPTS) implications of future weapons systems and equipment. Military, civilian, and contractor requirements are being rigorously reviewed in conjunction with various acquisition milestones. These initiatives are designed to improve our ability to address MPTS implications early in the acquisition process, thereby ensuring that manpower provides maximum combat capability at an acceptable cost."³

Even such broad policy outlines are clear enough for major implications to be discerned.

First, we can expect manpower reports will be required at every stage of the DOD weapon system acquisition and deployment process. In effect, this will mean that manpower-related factors will be added to the cost, schedule and technical/operational factors now included in the program baseline requirements.

Second, consideration of MPTS implications will be required of all systems, not just major ones for which congressional reports are required.

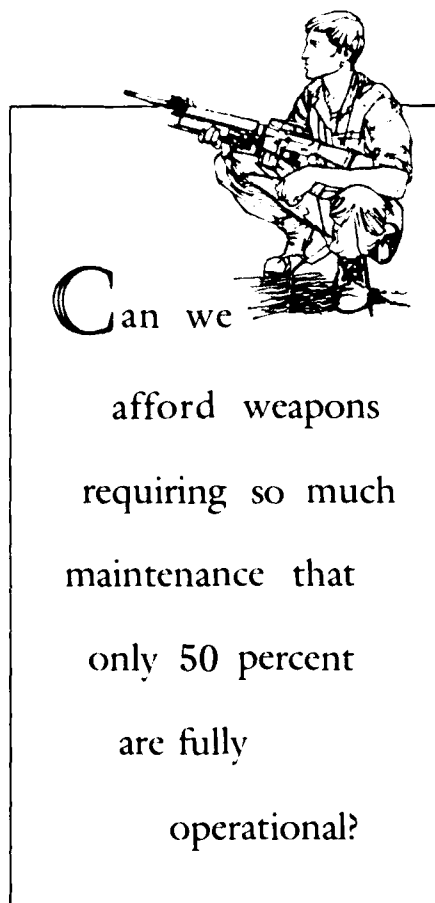
Third, weapons proposals and designs that are approved can be expected to need fewer people, use lower skill levels, require less training, and have fewer safety and health hazards.

Fourth, companies responding to these needs will be favored in contract competitions. Companies not responsive will lose in the bidder evaluation process.

Fifth, industry and the Services will be required to share information and work closely to give real meaning to human resources.

MPTS Concerns

This article uses information presented at a conference sponsored by the Manpower and Training Committee of the National Security Industrial Association. Representatives from defense industries, Office of the Secretary of Defense, human resource laboratories of military services, trainers and manpower planners met for 3 days to seek information and to develop ways to integrate manpower, personnel, training, and safety (MPTS) into the acquisition process. Successfully bringing MPTS concerns into the weapon program process development will require close cooperation between industry and the Services to assure needed information is shared and that MPTS impacts are clearly understood. This implies several changes in fundamental premises underlying the way weapons programs are run.



SYSTEM ORIENTATION. If a soldier in the field under reasonable conditions can produce only 82 percent of the accuracy that a system is capable of delivering, then we have not defined the system. In fact, the Services do not buy weapon systems; they buy hardware, software, data, and training and support services. Only when young enlistees (operators and maintainers) are included in the loop with these items does a weapon system exist. When a person is accepted as a critical element in system performance, that element becomes a focal point in system design.

Dr. Deming and others said when quality of output is poor, about 5 percent of the problem can be attributed to the worker and the other 95 percent to the management that designed the system. It is management's responsibility, with full input from workers, to redesign the system. For military services and the defense industry, this has important weapon system implications. Soldiers or sailors cannot be blamed for poor systems performance; the fault lies in the design which does not permit them to operate at the right

levels of performance. Appropriate system design would take into account abilities of the available people expected to operate and maintain that system. This has not always been the case.

QUALITY. Military services recognize there probably will be fewer young people entering the labor force (who are) available for entry-level jobs. Colleges and industry should provide the Services stiff competition to enlist the best from this smaller labor pool. The Services, in spite of current recruiting successes, may have to settle for fewer people, with less ability, in the future. This implies that increased use of user-friendly designs of weapons and equipment will be essential if weapons are to be effective. Reducing the number of operators and maintainers will be more important, due to the increased cost of available enlistees.

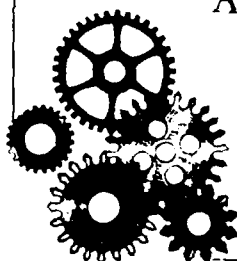
The Services have had to develop increased numbers of different maintainer specialties as the technology level of weapon systems has increased. This increases training costs, requires more personnel, and reduces the ability of the Service to flexibly assign people where they are most needed. It would be advantageous to use more generalists in the maintaining of weapons, but that can only occur if weapons are *initially* designed for the generalist. Such designs would provide, for example, more built-in tests, maintenance aids, and operating guides. Adding training programs to reshape people to fit the weapons would give way to carefully designing weapons to fit the people.

Industry can reduce the Services' needs for constant retraining by using *standard* approaches and designs rather than trying to make *new* systems look and operate differently. While this is a way to carve out a niche for commercial products, it should not be characteristic of future military systems. We may need to consider developing standard layouts for cockpits, radars, computers and other equipment to minimize the need for relearning when moving from one piece of equipment to another, and to enhance the assignment flexibility of the Services.

CUSTOMER ORIENTATION. Many companies are aware of the need for a clear customer/user orientation in their products, services and strategies. There is a need for a similar orientation to the customer/user in military programs. The *real* customer is not the Congress, the Department of Defense, the weapon system program manager, or officers in charge of the field units. Hardware designers, taking the MPTS challenge seriously, find that *real* customers and those able to provide needed information are the enlisted soldiers, airmen, and sailors operating and maintaining the weapons. Extensively using field maintenance crews to advise designers has resulted in a new turbine engine requiring *one* wrench to restore any field-replaceable component. Designers *must* bring the design laboratory to the field, or soldiers to the design laboratory, if we are to take seriously the Secretary of Defense call for man-machine systems to be structured in the most cost-effective manner. The military will probably recognize more than ever that *true* customers of weapon system designers or defense contractors are *enlisted personnel*, whose opinions will be the most valuable. The challenge is to deal with these facts in the military structure, and to recognize that design advice is as important as field exercises in using operation and maintenance crews.

MANPOWER LIMITS. The second and third parts of the congressional manpower estimate report involve estimating increases in military and civilian end-strengths required for full operational deployment of the program, and the manner of deployment if no increases are authorized. The net effect of these requirements will be to place all weapon programs, not just major defense acquisition programs, under a mandate to design programs that minimize the use of civilian and military personnel. Any major program requiring additional personnel runs the risk that the Congress may not authorize additional end-strength. The Department of Defense and the Services recognize that this spreads the implication far beyond the specific program.

This article uses
information presented
at a conference
sponsored by the
Manpower and
Training Committee
of the National
Security Industrial
Association.



For example, it is estimated that the Midgetman program will need about 50,000 persons for its security requirements. Where are personnel to come from? Rather than risk that the Congress may refuse to grant more personnel, the Services may choose to take personnel from other activities; one way is to make sure new weapons are designed to use fewer personnel, as compared to the system being replaced. The need to conserve personnel to provide for the introduction of new systems, especially those not replacing existing systems, carries two implications.

First, the program should use minimum people. To assure this need receives attention of program managers and designers, each major

program can expect to report on, and justify, its manpower usage at each program milestone. This will encourage consideration of possible trade-offs from the beginning of the program.

The second implication results from the fact that there will remain programs requiring added manpower which must be met from elsewhere. Some manpower spaces could be made available if all programs, especially those replacing or modifying existing systems, operated under manpower minimization requirements. This implies that the MPTS reporting and minimization requirements be extended from only the congressionally required major programs to include all programs. In this way, a replacement truck or artillery piece that requires fewer operator or maintenance personnel may free up manpower spaces for use in some other program. It is clear that this has major implications for organization structure and manning levels. Early and accurate estimation of manpower requirements then becomes important to every program manager and system designer.

MANPOWER ESTIMATION. When the acquisition of a new weapon has reached full-scale development or production and deployment, its MPTS requirements should be predictable. This is not the case in earlier stages of the process. In the initial concept development phase there is substantial flexibility to change design features. This implies a need to understand how a specific design feature may affect the MPTS requirements. The Services have been developing MPTS estimation approaches that will be essential to this process. The purpose of the Navy HARDMAN, the Army MAN-PRINT, and the Air Force IMPACT programs is to predict in a better way what operation, maintenance, support and training personnel will be required for a particular configuration of forces, weapons, and support concepts. Procedures are developing but are in use and contribute greatly to assess implications of designs before they are locked in. Program managers will continue to need experts' advice in these areas, but must be personally familiar with programs.



Procedures developed by the Defense Training and Performance Data Center enable the Services to improve MPTS requirements prediction by knowing about the connection between types of equipment, military occupational specialties involved in operation and repair, and required training. Using these procedures and data banks will help predict MPTS consequences of new classes of weapons, or of proposed design changes. They should help the Services estimate the number of people, their expected mental capability level, and the amount and type of training a particular equipment design implies. Program managers will be able to make MPTS comparisons of proposed alternative designs, even in the early stages of the project. This information would be invaluable in achieving the cost-effective use of future manpower resources, since manpower implications could be considered with cost implications of a proposal.

Conclusion

Effective integration of MPTS into all phases of design, production, operation and support will require major changes in the ways industry and the Services interact. Free exchange of information and clear delineation of MPTS expectations must characterize the relationships. It can be done.

CLARIFICATION

In the July-August 1988 *Program Manager*, in the article, "C/SCSC Lessons Learned," by Dr. Anthony Webster, the first sentence needs clarification. The C/SCSC was introduced by the Department of Defense and not by Arthur D. Little, who conducted a survey on C/SCSC on behalf of the Assistant Secretary of Defense (Comptroller).

The turbine engine, cited above, not only requires *one* wrench but has *one* length of bolt and does not require removing several parts to get at the one to be replaced. This makes maintenance tasks easier, less subject to error, and reduces the time equipment is unavailable. Such achievements, not easily won, are characteristic of stories we will probably hear in the future.

Economists are quick to point out that TINSTAAFL (There is no such thing as a free lunch) is a basic law of economics. This applies to MPTS considerations. Successfully integrating all concerns into the design, production, and deployment of weapons systems will entail considerable costs. Most additional costs will be in the earliest stages of a program. This is particularly pertinent when MPTS considerations must be taken into account before submission of a bid on a proposed program. Companies cannot realistically be expected to add these considerable costs to the existing burden of unreimbursed bidding costs. Is the Department of Defense ready to pay companies to bid on new programs, even if bids are not accepted? How important are MPTS concerns during a period when the Defense budget is expected to remain stable or lessen? Payment of up-front MPTS costs to bidders would be convincing evidence that the Department of Defense is serious.

The military and the defense industry are being pushed toward new definitions of design requirements, customer satisfaction, and weapon system performance. Significant efforts will be required from both sides to further develop necessary tools and techniques for early and accurate estimation of manpower and skill-level requirements of systems before they are built. Working together, freely sharing information, and realistically assessing and trading-off different aspects of MPTS concerns and costs would have major impacts on the future size, shape, and effectiveness of our fighting forces. Can we afford to ignore this challenge and continue in the same old ways?

Endnotes

1. President's Blue Ribbon Commission on Defense Management, 1986, *A Quest for Excellence: Final Report to the President*, pp. xii.
2. United States Code, Title 10, Section 2434.
3. The Honorable Frank Carlucci, *Secretary of Defense Annual Report to the Congress, 1989*, Superintendent of Documents, pp. 151-152.



Dr. Boynton is an Associate Professor of Management, Defense Resources Management Education Center, Naval Postgraduate School, Monterey, California.

LETTERS TO THE EDITOR

Please address letters to *Program Manager*, ATTN: DRI-P, Defense Systems Management College, Fort Belvoir, VA, 22060-5426.

The Defense Systems Management College plans to initiate a *Letters to the Editor* column in *Program Manager*. We welcome *your* letters, pro and con, regarding articles that have been published in *Program Manager*. Your opinions are of interest to the College and we seek your ideas regarding our publication; content, authors, subject matter, readership, etc.

Letters should include the writer's full name, address, and daytime telephone number. Unsigned letters will not be used. Letters may be edited for purposes of clarity and space.

Let us hear from you. If the response is immediate, the *Letters to the Editor* column will begin in the January-February 1989 issue.

THE DUPONT MODEL

AND THE EXPERIENCE EFFECT

AS TOOLS OF

STRATEGIC MANAGEMENT

Fred Waelchli

David Westermann

Dr. Waelchli is Professor of Management at the Defense Systems Management College, and a member of the DSMC Center for Acquisition Management Policy. Mr. Westermann is the James Forrestal Memorial Professor of Industrial Management at DSMC, and was, for 14 years, the Chief Executive Officer of the Hazeltine Corporation.

Early in this century the DuPont company discovered, in a simple accounting formula, the basis for a guiding philosophy of management. Eventually, the philosophy embodied by that formula became a model around which the entire DuPont organization and its activities were organized (Drucker, 1985a).

In a separate but related development, starting in the 1920s and 1930s, researchers on human productivity, notably T.P. Wright (1936), found ways to quantify and describe mathematically the so-called phenomenon of "learning"; the well-known observation that as humans continue to perform a mechanical operation they get better at it. About 20 years ago, the Boston Consulting Group found that this phenomenon also applies to mental and managerial operations, and retitled the expanded concept "experience" (Boston Consulting Group, 1972).

In recent years the Dupont model and the phenomenon of experience have been welded together to form a strategy of management. This article outlines a version of that strategy, a version that emphasizes certain decentralization implications inherent in both constituents of the strategy, as they apply to the publicly held company. Although in developing our argument we will use a number of terms common to the accounting profession, the reader should understand that this is not a professional accounting treatise. We assign to some familiar financial accounting concepts, notably "assets," much broader meaning than does the accountant's lexicon.

There are several reasons for discussing this model here and now. First, the strategy described herein is used by many (though by no means all) defense contractors. Second, certain aspects of the model apply to all publicly held companies (including defense contractors), whether or not they

espouse the strategy described. Third, within the last year we have seen a number of studies that call into question or "view with alarm" the current financial health and future viability of the U.S. defense industry, as a consequence of a series of legislative and DOD actions directed at defense acquisition management (Waelchli, 1988, reviews three of these studies). The material in this article is designed to help the reader understand and evaluate these and other data related to the financial health of individual defense contractors and to the defense industry as a whole.

PART 1: WEALTH, RISK, PROFITABILITY, AND THE DUPONT MODEL

Owners of wealth typically seek ways to make that wealth grow. One possible way to increase wealth is to invest it; that is, to employ it, through markets, in ways potentially valuable to society, thereby earning a return. Markets are characterized by risk. In the free interaction of buyers and sellers, many different investment vehicles beckon the owner, offering a spectrum of potential rates of return. But, as a rule, opportunities for faster growth of wealth occur because there is also a greater probability of losing all or part of the investment; i.e., more risk.

In the last half-century or so, owners have increasingly turned to hired "management" to balance risk-reward considerations and perform the function of making wealth produce a return. The owners' wealth (called equity) with additional funds provided by borrowing (debt) is entrusted to management, which is legally bound to employ those assets in the best interest of the owners.

In the daily work of operating a business, the management of a publicly held corporation must, and other managements should (we believe) seek, as a first concern, to obtain a competitive risk-adjusted return on the total assets entrusted to it. Among the key measures of management performance are the amount, quality, and consistency of the return it produces, over time, on total assets.

The Cycle of Business

The traditional model of the productive business use of capital (or assets) is the "cycle (or circle) of business." Starting with cash, management (guided by corporate goals, values, experience, and technical knowledge) purchases materials and parts, employs land and capital equipment as appropriate, and buys and applies labor to form work-in-process inventory and then finished goods, or product. This product is sold to realize accounts receivable and, ultimately, cash. An analogous process takes place in a firm that offers services rather than goods.

If things go well, the amount of cash realized is greater than the cash consumed. This difference, gross income, is a market-determined declaration of the value added by the firm to the value of the inputs it used (materials, parts, labor), and the value of the capital assets consumed, in creating the product. The cash surplus, after payment of interest on debt and taxes, can be returned to the owners or be retained in the business to allow it to compete more effectively, grow stronger or bigger, or diversify.

Profit Margin

The financial result of a cycle of business is expressed in financial accounting as "profit margin," which is computed as follows: The costs of labor, material, management, interest

TABLE 1. THE DUPONT FORMULA

$\frac{\text{Net Income}}{\text{Sales}}$	\times	$\frac{\text{Sales}}{\text{Total Assets}}$	$=$	$\frac{\text{Net Income}}{\text{Total Assets}}$
$\left(\begin{array}{c} \text{Profit} \\ \text{Margin} \end{array} \right)$	\times	$\begin{array}{c} \text{Asset} \\ \text{Turnover} \end{array}$	$=$	$\left(\begin{array}{c} \text{Return on} \\ \text{Investment} \\ \text{(ROI)} \end{array} \right)$

on debt, depreciation, and taxes are subtracted from the revenues realized from sales, to get "net income." Net income is divided by total sales revenue to get a percentage; this percentage is profit margin. Profit margin represents the income earned by each dollar during one cycle of business. Profit margin, or "net income on sales," is a standard financial accounting measure of profitability and business performance.

Return on Investment (ROI)

Profit margin is only a part of the profitability story. Because (as noted) corporate management is fundamentally a steward for assets entrusted to it, that management must be primarily concerned with the periodic return on each owner's dollar or, in accounting terms, net income on stockholder's equity (this measure is also called return on equity, or ROE). Further, many businesses employ borrowed funds as well as owners' capital, and management must achieve a competitive return on the borrowed funds as well.

For this reason, debt and equity capital are lumped together and called "total assets" or "investment." The ratio of net income to total assets is called "return on investment," or ROI. It may also be called "return on assets (ROA)," or "return on capital employed (ROCE)." We will use ROI as our index of profitability in this paper, but the reader should understand that different authorities and practitioners use these terms with different meanings.

Dupont Formula

Profit margin and ROI, two primary measures of profitability, are mathematically linked in the famous "DuPont formula," shown in Table 1 above. The third, or linking, term in the DuPont formula is "Asset Turnover," which is the ratio of sales revenues (in an accounting period) to total assets. Asset Turnover is a measure of the number of cycles the business accomplishes in an accounting period.

This relatively simple equation is more than a lifeless accounting statement. It represents, in our view, the foundation for a revealing model of business behavior.

The first term, profit margin, is a measure of the company's external effectiveness in its markets, particularly its ability to sell its products for more than it costs to make and market the products. Profit margin is primarily affected by a firm's marketing prowess, pricing strategies, internal operating effectiveness, and cost management. The second term, asset turnover, tells how many dollars of sales were generated by each dollar of assets used (or available to be used). Asset turnover measures management's internal efficiency in the use of its assets, particularly its effectiveness in generating business volume while minimizing the assets required to conduct any given volume of business. Taken together, the two terms help to clarify (among other things) an enduring and significant management dilemma, centralization versus decentralization of management, as we will see later.

Note that management can improve ROI (for a while) by systematically drawing down on company assets, thus partially liquidating the company. Note also that cash, like all other assets, is in the denominator of the ROI term, and thus is a drag on ROI unless it is producing an appropriate return.

The Firm and the Dupont Formula

Well managed firms strive to increase profitability by operating on both terms of the DuPont formula. They work hard to increase profit margins, attempting to push up the ratio of earnings to sales through product quality differentiation, through market extension, by optimizing pricing policies, through entrepreneurial product and service innovation of the type chronicled by Drucker (1985c) and Clifford and Cavanagh (1985), and through effective management of operations, cost, and quality (e.g., Deming, 1986), among other things.

These firms also seek improved asset turnover by intensive cash management, by keeping all assets at work continuously and effectively; by improving productivity of each asset (especially people); and by keeping idle, unused, or underutilized assets to a minimum. Some firms find they can amplify asset effectiveness by deeply delegating asset use authority; by transferring asset deployment and redeployment decisions to the working level, thus promoting flexibility, spurring asset productivity, boosting motivation, and eliminating hold-ups for higher level approvals.

When evaluating proposed investments—in facilities, equipment, education and training, ventures, or other opportunities—many well-managed companies use a discounted cash flow (DCF) approach to Return on Invest-

ments. That is, they translate ROI elements into cash flows—"cash out" (investment) and "cash in" (receipts)—and account for the time value of money by using the net present value (discounted at the company's cost of capital) of each cash flow. One currently popular view of strategic management claims that the strategic task of management is to maximize the value of the firm, which is taken to be the net present value of all future cash flows (see Kiechel, 1988:36). Note that we are talking here about actual cash flows, not the chimera of accounting profits.

People as "Assets"

Total Assets include everything the company (stockholders) owns, plus everything that it hires; specifically, land, buildings, equipment, all forms of inventory, accounts receivable, and cash.

Most important among the firm's assets, in our view, are people; men and women with brains, skills and motivation. In the formal accounting sense, of course, people are not listed as assets on the balance sheet. Compensation paid to people and costs of hiring and training them do reside in inventory and accounts receivable and, therefore, in the Total Assets term, until payment is received for the product.

In a deeper, more philosophical sense, however, we believe that people clearly count as assets. In fact, people represent the improvable asset, the asset of ultimate value (cf., Kanter, 1983). A company gains productivity leverage through training, education, and motivation of its people, and then by exploiting these qualities in a decentralized decision structure, as we discuss later. People can do what inert capital equipment cannot, learn and improve as individuals and as teams.

Improving Asset Turnover

What methods can management use to increase asset turnover? From the mathematics of the formula, two obvious answers are to increase sales volume and decrease assets, but there is much more to it than that. The fundamental meaning of this term, and the key challenge to management, is that every asset must make a continuous and effective contribution to net income. Asset turnover can be increased by increasing the realizable value per unit of inventory, or by increasing the velocity of the business cycle; the rate at which cash is turned into finished goods inventory and back into cash. Sometimes an asset contributes to net income only indirectly—by making another asset (or assets) more efficient or productive.

Performance in the task of making assets optimally productive is an acid test of management. This responsibility translates into tactics such as those listed by Chisholm (1985): Keep all assets working as hard as possible all of the time. Minimize all forms of inventory and other assets, convert all inventories into cash as quickly as possible, and keep all cash working, even overnight. Here also, decentralization of asset deployment authority frequently improves the payoff by fostering nimble responses to local opportunities and problems.

Most assets have intrinsic, inherent, or mechanical limits on potential productivity. Good management can squeeze more productivity (in the form of increased volume of product or perhaps more efficient or less costly operations) out of these assets, but only in limited amounts. As noted above, however, there is one asset that appears to have no intrinsic limits on its productivity, and that is man. Associated with humans in work situations are the phenomena of "learning" and "motivation," the second fundamental element of our model of the firm, to be discussed below.

PART 2: THE PHENOMENON OF LEARNING

Asset turnover is a measure of efficiency. It depends on the full, effective, continuous utilization of assets deployed—facilities and people. That requires skillful internal management of operations. But asset deployment must also be competent and well-advised. Productive capacity, a function of capital (physical assets), materials, and inventories must be maintained in balance with product demand—the organization must avoid significant over- or undercapitalization. Most important, management must anticipate changes in product demand triggered by strategic management actions and market conditions, so that new capacity comes on line as needed. Finally, business conditions must allow a reasonable opportunity, if the business involves manufacturing, for a planned, stable, volume production operation.

Stock Price and Earnings

As steward for the asset owners (stockholders), management accepts responsibility for the *total* return on those assets. Total financial return includes, in addition to dividends, the net change in the price of the stock from purchase to sale. An important determinant of stock price (and of the firm's cost of capital) is the amount of earnings (net income) available for distribution, and the rate of change in earnings. Management, therefore, must be concerned with two additional important measures of financial performance; earnings per share and the price-earnings (P/E) multiple.

Earnings per share is quarterly or annual net income divided by the number of shares of stock outstanding. This number serves as a trend indicator; changes in the value of earnings per share are closely watched by the financial community because they can be precursors of dividend changes. The price per share of company stock is set by the actions of buyers and sellers in the equity markets, and normally represents the market's evaluation of current earnings per share and of the future Return on Investment prospects of the industry and the company. Said another way, stock price expresses the market's expectations of the durability of company earnings. A company's P/E multiple, compared to

those of its competitors, is a market assessment of the relative "quality" of the company's earnings, its prospects for future earnings, and the quality of corporate management.

Price-earnings performance also affects the ability of the company to attract new capital (debt and equity), and the price it will have to pay for that capital. The P/E performance affects the company's ability to finance its competitive efforts to grow and diversify and, ultimately, the cost and quality of its products. Poor P/E performance can lead to a lower stock price and a higher cost of capital, which may lead to worse P/E performance in the future, and into a downward spiral toward mediocrity or eventual failure. At the very least, declining performance in the capital market predisposes toward declining performances in the product market. Poor or declining P/E performance can also become an invitation to a hostile takeover attempt.

Hence company management, even as it invests for long-term Return on Investment, must also emphasize current or short-term earnings to protect its stock price and P/E multiple.

Summary of DuPont Model

The DuPont formula gives the manager insight into types of actions he or she can take to make the firm competitive. The behavior of the firm's stock price, particularly as a multiple of its earnings, tells the manager how the financial market judges the firm's competitive performance, and especially its anticipated future financial performance.

The cold financial figures reflect management's performance in the product market and within the company. Internally, our focus has been on management's performance in the deployment of the organization's assets. A major facet of this performance is the skill with which the firm's human assets are motivated, trained and used. We will consider two aspects of "human asset management"; first *development* of the individual by motivation, learning, and experience, and then optimal *use* of the individual in a decentralized management framework.

It is common knowledge that human repetition of a task leads to faster and better accomplishment of the task, and that fabrication cost of a new product is likely to decline in its early life. Starting in the 1920s and during World War II, this knowledge became more explicit. First, it was found in industrial production that, on a shop floor under stable conditions and with good management, for each cumulative doubling of quantity produced, there is a measurable and predictable percentage reduction in the labor time and therefore in the cost.

Studies by the Boston Consulting Group starting in 1966 have shown this phenomenon is not confined to labor or to the shop floor, but is a pervasive phenomenon that applies to all cost elements. This broader phenomenon is the "experience effect," or the "experience curve effect" (Boston Consulting Group, 1972).

The experience effect on costs is likely to be steeper than the labor cost decline; it applies to the aggregate of capital costs, development, marketing, distribution, overhead, and operations. It derives from scale effects, investment, and specialization as well as traditional learning.

The so-called learning/experience curve has become an indispensable tool of cost and price management. Experience curve implications for competitive strategy are significant, but often seem to be poorly understood.

Strategic Applications of Learning/Experience

A well-managed company working strategically to alter the competitive structure of an industry to its own advantage will seek to capture, by a variety of means including planned investments and pricing strategies, a larger market share in a market segment; a share that will provide the cumulative volume over time that generates the learning and experience required to propel it down the cost curves ahead of its competitors. If successful, this strategy ultimately gives the company a potential sustainable cost advantage difficult for competitors to overcome and, therefore, relatively higher profit margins at any market price.

Seizing cost advantage through learning is not easy and demands substantial investment, particularly in human capital (Kaptur, 1987). It requires nurturing the learning phenomenon. It means building and leading an experienced, well-trained, well-motivated, multidisciplinary, multitiered work force and holding it together through lean times. It means resistance to personnel layoffs, regardless of short-term market conditions. It means continuous promotion of individual and team learning, formal and informal, at all levels of the organization, all the time. It means visible and reliable management behavior that champions, not hinders, individual and team initiative and learning throughout the company; behavior leading to development and maintenance of a tangible and shared corporate value system, a work environment conducive to continuous learning, and to intense belief in, and respect for, the institution, its objectives and its people. William Safire (1986) argues cogently that "Companies have to recognize that employee loyalty is a substantial asset." We believe that the experience effect is a phenomenon of the heart as well as the brain.

In Monograph 235 of its "Perspectives" series, the Boston Consulting Group took a breather from its customary hard analyses of strategy, and underscored the importance of leadership in human terms:

But few things in life are more satisfying than pride of membership...in an organization which itself is respected, admired and valued by the society of which it is a part. Organizational objectives encompass...the value system and the culture of the whole person, not just the tangible pay-offs....The objectives that are valued may often go beyond the present and beyond self.

....The consensus upon objectives is the only tie that binds its members to the purposes of the organization and holds them strongly enough to override their personal objectives....Strategy development is wasted effort if there is no such commitment to objectives. (Henderson, 1981)

A coterie of current writers, led by Peter Drucker (1974, 1985c), William Ouchi (1981), Tom Peters (1982, 1987), Robert Waterman (1982, 1987), Rosabeth Moss Kanter (1983), and Clifford and Cavanagh (1985), echo this theme. People, operating under competent, value-driven leadership; people well trained and motivated, resonating to corporate values and to principles of learning and experience, are the ultimate asset. Without them inert capital assets remain just that—inert. With them immense productivity gains are possible, even under otherwise adverse conditions.

We believe that individual and team learning are key to the efficiency that drives asset turnover, ROI and, ultimately, total market performance. The individual must keep at work, and the team must keep working together, generating cumulative volume of product, doing it better, with higher quality, and at less cost as they go.

This requires stable employment. The work force must keep working; assets must not be idle.

This requires program and funding stability, and efficient work scheduling so that operations are not interrupted and learning is not disrupted.

And the work force must be motivated. This requires leadership—managers constant in their visible commitment to values important to the workers. We believe those values should include efficiency, integrity, and a sense of public citizenship and trust; the leader must be strong enough to rely, in the main, on the commitment of the work force to the shared value system. In the words of J.D. Brown (1973:23):

It appears to be in the nature of human organization that...the great majority of constituents react to the persistent image of the leader rather than to the precise logic of his decisions. The image of the leader is not his superficial self, but rather the personification of a system of values which he has demonstrated over time. When this manifestation is clear and consistent and reflects a quality of personal integrity, it is a powerful instrument.

Management must make optimal use of individuals in this trained and motivated work force. We believe this is best accomplished through intelligent and appropriate decentralized decision-making. The DuPont model sheds light on this aspect of management.

PART 3: THE DUPONT MODEL AND DECENTRALIZED MANAGEMENT

We have stated our belief that the DuPont model is more than a lifeless accounting formula; we see it as the foundation of a model of business strategy. An important aspect of this strategy is decentralized decision-making as we have noted above. The DuPont model illuminates the meaning of decentralization, offers an avenue to the rational use of decentralization, and suggests a way to measure the actual degree of decentralization.

Many managers believe (or say they believe), with the American Management Association, that decision-making should be decentralized; that decisions should routinely be pushed down to the lowest level in the organization where all the information needed to make a good decision resides. There are three widely recognized structural modes of decentralization: the cost center, the profit center, and the ROI center. The DuPont model helps clarify what decentralization means in each case.

The cost center is the most centralized of the three modes; it allows the local manager one axis of decision—the cost budget. In addition to routine management of material and labor costs, this manager can (at least in theory) control production quantity (i.e., sales) and can lower quantity when unit costs threaten to escalate with high volume, due to bottlenecking, overtime, labor fatigue, or the inefficient use of capital equipment. This manager's discretion is confined to one element of Profit Margin—cost.

The profit center allows more local control. This manager is fully responsible for Profit Margin, or earnings (revenue minus cost) as a percent of sales. In addition to measures available

to the cost center manager, this manager can make decisions that incur higher costs than planned if he can also boost revenues and drive net income above plan.

But both the cost center manager and the profit center manager are tied to the Profit Margin term of the DuPont formula. The ROI center manager, by contrast, has all the tools of the profit center manager, plus some control over asset ownership and asset turnover. Under the ROI center concept, the local manager negotiates with corporate headquarters the makeup of the specific asset base for which he or she will be held accountable, and the return (income) expected on that asset base. This manager can then choose (for example) to cut profit margin to gain market share if so doing would increase ROI. He can influence, to a degree, his "capital structure." He can, in the drive to elevate ROI, negotiate further with headquarters about asset "ownership"; perhaps returning or re-deploying unused or underused assets, and/or requesting or accepting new assets on which he foresees the likelihood of a favorable return.

This manager becomes, in a sense, the CEO of his local operation. Note again, however, that this strategy demands a broader view of "assets" than the accountant's. Asset "value," in this strategy, must relate to the potential productive use of the entity, not to a depreciated "book" value—otherwise we risk the lunacy of motivating an ROI manager to seek "ownership" of an old, tired asset, rather than a productive new one—because the "book" value of the old asset is low, and minimizes his asset base.

Intelligently employed ROI management seems to us to be a true expression of decentralization and, further, to invite "human asset" management that spurs innovative and productive use of the trained and motivated work force. We recognize that the effects of structural decentralization fall most immediately on top managers of the organization. But the same type of thinking about delegation and motivation that animates the ROI form of decentralized management should

permeate the organization and influence all levels of administration and supervision from the Chief Executive Officer to the shift worker. An effective ROI manager will be, *ipso facto* we believe, a decentralized manager.

But how many companies, even "well managed" ones employ ROI management? How many organizations argue that they are decentralized because they employ cost centers or, better yet, profit centers? Which "decentralized" firms routinely, or ever, effectively delegate ROI responsibility to any significant depth in the organization? How many "enlightened" or "excellent" organizations display (publicly or privately) any evidence of understanding the potency of ROI-based decentralized management? Based on our experience, the number is not large.

Summary of the Argument

One more time; the logic of the DuPont formula shows two routes, profit margin and asset turnover, that a firm may take to achieve the profitability that every firm must earn to stay in business and compete for capital (human and financial) in the free and open markets of this country. The DuPont formula is not, itself, a strategy; it is a financial model of a firm that offers goods and services to a market. The concepts of Profit Margin, Asset Turnover, and Return on Investment, however, apply to every such firm, and analyses based on these concepts can reveal effective strategies (e.g., decentralization) and lead to improved strategic decision-making.

Nor is the phenomenon of learning or experience, *per se*, a strategy. We know that some learning occurs naturally, but management actions drastically affect the quality, quantity, and effectiveness of learning in the organization. Furthermore, the decision to *invest* in learning, to nurture and manage learning for the purpose of making assets, human and inert, more productive, is a strategic decision. Within the framework of the DuPont model, a dedicated learning-based approach to total company management can be (we believe) an effective conscious company strategy, one that can lead to increasing effectiveness and competitive market advantage.

Learning starts with the management attitude that people are assets; in-

telligent beings who respond affirmatively to a principled and real company value system and who, with bureaucratic roadblocks removed, will drive toward achievement of shared company goals. A "learning" strategy depends on the belief that a deep and dominant human desire is to be a contributing member of a winning team.

Philosophy Within the Model

There is one more point to be made. The strategy we sketch is often characterized as applicable primarily to high-volume manufacturing operations; it is sometimes called the "low-cost, high-market-share strategy," or the strategy of "cutting price to gain share." Ghemawat (1985), for example, warns that the experience effect is applicable only in certain well-defined industrial situations.

We believe a deeper phenomenon is at work, and that warnings such as Ghemawat's indicate that the phenomenon of learning/experience may be too narrowly understood.

The logic chain goes something like this: Management generally is a steward for assets (defined here more broadly than in the accounting sense) entrusted to it; this is true whether the assets are private or public, owned or hired. Management as a function, then, is largely *asset* management, the task of making each asset as productive as possible and, in particular: making it produce (whether rented consumed or amortized) more value than its cost. (It is also becoming clear that adroit asset management is a natural and potentially powerful antidote to hostile takeover—see Kiechel, 1988.)

The "asset" with the greatest capacity for increased productivity—its own and that of all other assets—is the human being. A primary avenue to increased human productivity is "learning" or "experience," both in the vernacular sense, and as those terms have been described. To be more than minimally effective, learning must be promoted and actively managed and then, we believe, applied in a decentralized decision structure. The underlying argument—and strategy—therefore, is that regardless of the type of organization—be it a supplier of services, or a fabricator of products—a first priority for management is attention to, investment in, and leadership of the organization's human capital.

References

Boston Consulting Group, (1972), *Perspective on Experience*, Boston Consulting Group.

Brown, J. Douglas (1973), *The Human Nature of Organization*, N.Y.: American Management Association.

Chisholm, William D. (1985), "Return on Assets/Investments Considerations for Contract Managers," *National Contract Management Journal*, Vol. 19, No. 2, pp. 57-66.

Clifford, Donald K. and Richard E. Cavanagh (1985), *The Winning Performance*, Toronto: Bantam Books.

Deming W. Edwards (1986), *Out of the Crisis*, Cambridge: MIT Center for Advanced Engineering Study.

Drucker, Peter F. (1974), *Management: Tasks, Responsibilities, Practices*, N.Y.: Harper and Row.

Drucker, Peter F. (1985a), "Measuring Business Performance," in Drucker (1985b), pp. 75-80.

Drucker, Peter F. (1985b), *The Changing World of the Executive*, N.Y.: Times Books.

Drucker, Peter F. (1985c), *Innovation and Entrepreneurship*, N.Y.: Harper and Row.

Ghemawat, Pankaj (1985), "Building Strategy on the Experience Curve," *Harvard Business Review*, March-April.

Henderson, Bruce (1981), "Objectives and the Organization," Boston Consulting Group, "Perspectives" series No. 235.

Kanter, Rosabeth Moss (1983), *The Changes Masters*, N.Y.: Simon & Schuster.

Kaptur, Marcy (1987), "Companies' Education Investment Pays High Dividends," *The Wall Street Journal*, October 26, p. 26.

Kiechel, Walter (1988), "Corporate Strategy for the 1990s," *Fortune*, February 29, pp. 34-42.

Ouchi, William G. (1981), *Theory Z*, Reading, Massachusetts: Addison-Wesley.

Peters, Thomas J. and Robert H. Waterman, Jr. (1982), *In Search of Excellence*, N.Y.: Harper & Row.

Peters, Tom (1987), *Thriving on Chaos*, N.Y.: Alfred Knopf.

Safire, William (1986), "The Crisis of Institutional Loyalty," *The New York Times*, August 18, p. A17.

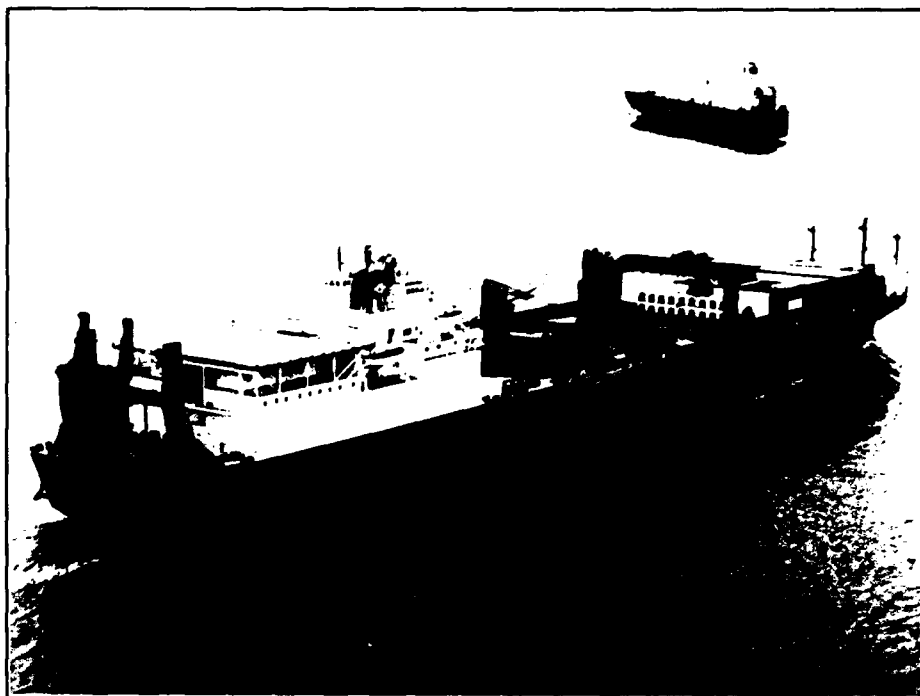
Waelchli, Fred (1988), "A Capital Crisis in the Defense Industry?" *Program Manager*, July-August.

Waterman, Robert H. (1987), *The Renewal Factor*, Toronto: Bantam Books.

Wright, T.P. (1936), "Factors Affecting the Cost of Airplanes," *Journal of the Aeronautical Sciences*, February.



As part of an extensive effort to upgrade strategic sealift capability, the Military Sealift Command is acquiring 13 new or converted ships specifically configured for maritime prepositioning missions, including the Sgt. Matej Kocak, shown.



MAKING SMART LOGISTICS MANAGERS

Michael E. Harris, C.P.L.

Military Environment of the Near Future

The world of the near future will be more interdependent, more complex, less stable politically and economically, and more vulnerable to disruption than the world today. Serious conditions involving increased population, disparity in wealth, regional conflicts, arms proliferation, and unstable political and military structures are likely. There is the likelihood of comparatively fewer resources and greater commitments. The military of the future will exist in a social, economic, and international environment fraught with conflict and stress. Figure 1 depicts some of the conflicts and stresses.

For U.S. military forces, acquisition programs and combat force operations usually have been single service. More acquisition programs will be joint programs, both with other services and with foreign governments. This will occur as U.S. military commitments increase and resources decrease.

Changing Operational Support Environment

As the acquisition and operations environments change, the logistic support environment will change.

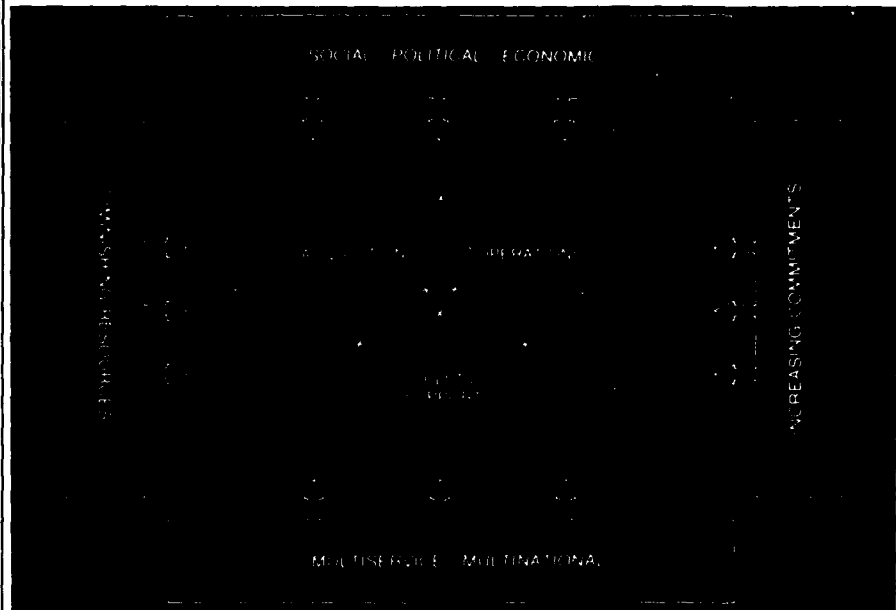
The Free World will continue to rely on sophisticated technology to offset the numerical advantage of Soviet bloc forces. This emphasis on high technology has afforded and

produced increased weapon system capability and subsystem reliability. However, this increased capability has greatly increased the number of subsystems and, thus, weapon system complexity. Consequently, improved reliability has not been realized at the systems level. Additionally, high technology has not provided the reduced operating and support costs frequently anticipated. Requirements for complex, sophisticated test equipment, technical maintenance skills, and costly repair parts have created logistic support problems which have resulted in an unacceptable level of readiness.

The support environment has become more complex. The combat forces' operational requirements must be supported. The basic logistics requirements, including readiness and sustainability, must be supported. The military and industrial production limitations must be addressed. Perhaps the most important factor in the increasing complexity of the support environment is data. The manufacturers, combat forces, support activities, and acquisition commands all have technical and management data to transmit and receive. Each participating activity has its own version of the required data in an automated system that is not quite compatible with all the other automated systems. Figure 2 shows some of the complexity in the operational support environment.

Military logisticians are responsible for ensuring that combat forces have sufficient supplies and equipment to deter aggression or to sustain military operations. To fulfill this responsibility, we need to look at two areas of concern, the military environment of the near future and the changing operational support environment.

FIGURE 1. SOME CONFLICTS AND STRESSES ANTICIPATED FOR THE MILITARY ENVIRONMENT OF THE NEAR FUTURE



Issue

The requirements for operating a defense force in a changing, global environment give rise to several tenets of logistic support. These tenets include the following: readiness, sustainability, flexibility, survivability and mobility. While all of these are of essentially equal importance, we will limit our discussion to *readiness*. Logistics planning guidance spans peacetime and wartime planning. While most of the major planning issues are unique to either peacetime or wartime, one stands out as being essential to both. That one is "trained logistics personnel."

Reliance on high-performance technology will require increasing numbers of people with the aptitude to learn to perform complex diagnostic and maintenance tasks, and to manage or direct large logistic support programs.

Making the weapon systems more sophisticated seems to increase the need for logistics technicians and managers. Trained logistics personnel are a resource just like any other resource, in short supply and becoming more expensive. We cannot increase significantly the supply of logisticians or the supply of logistics materials. We must make do with what we have now or will have in the near future.

The real issue, then, is to have the right resources available in the right place at the right time. This is the job of the acquisition command logistician. This is where we must start; we must make the acquisition command logistician the "smart logistics manager." To accomplish this, we need logisticians who understand their own jobs and how they fit into the overall support infrastructure.

Approach

There are three elements necessary to accomplish our goal. First, regardless of the details of the approach, the approach itself must be Department of Defense (DOD) wide. Second, the field/fleet logisticians must be trained to view logistics the same way as the acquisition command logisticians do. Third, the acquisition command logisticians must be educated/trained to manage the effort, not to do it.

DOD-Wide Approach

The initial step in the approach to obtaining smarter logistics managers is to have a DOD-wide approach to support for operational systems. This is not to suggest that all military services must provide support in the same manner. There must be a common approach to the support with a common

language. Because all the services obtain some of their support from common sources, some things must be common. Each service has a unique mission and a unique way of fulfilling that mission.

Ideally, there should be a comprehensive set of logistics policy statements by the DOD. These policy statements should address the basic goals of logistic support. They should state what should be done, but not specify how they should be done.

If we make the assumption that these DOD logistics policy statements do exist, then the next step is to address the individual service's logistic policy. Each service has a different mission and force structure. This means that each service will have a different approach to the logistic support of its operational forces. The service logistics policy must support DOD policy and provide additional guidance on implementation and reporting requirements.

In support of the service logistics policies, the various acquisition commands may need to implement differing logistics policies. Each acquisition command must be the final judge of the implementation of the logistic support policy. The commands must develop the detailed procedures, reporting requirements, and management information systems.

Training for Field/Fleet Logisticians

Given a general approach to military support for operational systems, the next step is to provide training for field/fleet logisticians. These logisticians are the doers. They directly support the field/fleet forces.

These field/fleet logisticians include managers, engineers, analysts and technicians. Some of these logisticians are integrators and managers while others are technical specialists. These logisticians are the ones who provide the logistic support to the combat forces. While it would not hurt if all the logistics personnel understood how all the logistics elements fit together, it is not necessary, or is it practical. The field logisticians must be trained to do their particular jobs; in addition, the field logistics managers must be

trained to understand how the logistics elements fit together. The field logisticians must be trained to know what to expect from the acquisition command logisticians. They must be taught common terminology and common procedures.

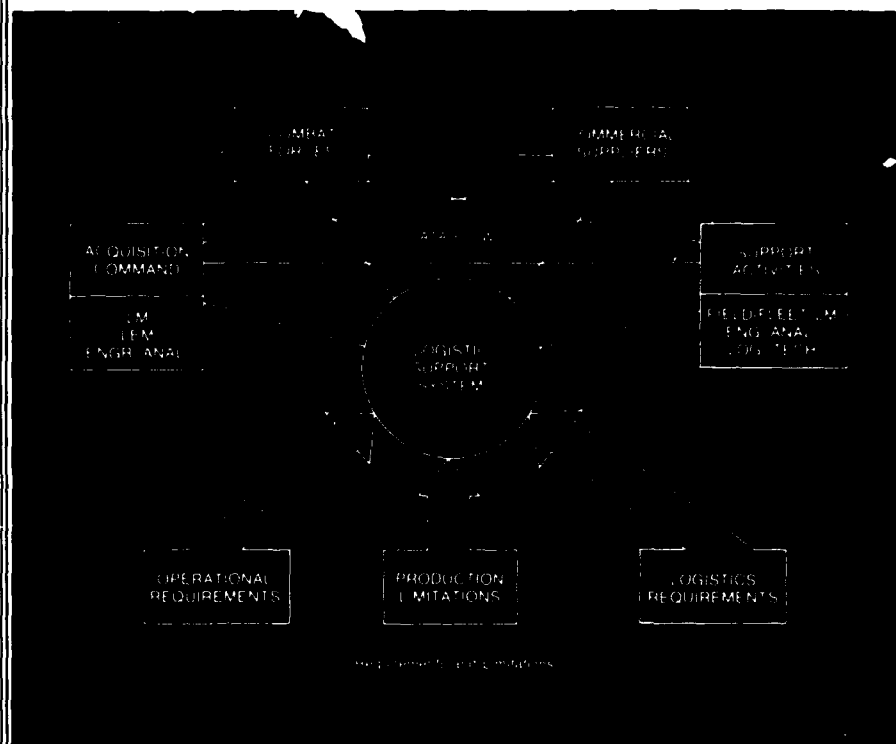
Education for Acquisition Logisticians

The acquisition command logisticians must be educated to manage the support programs; they must be educated or trained to implement their command's logistics policy. We have already stated that this policy supports the service and DOD logistics policy. The acquisition command logisticians include logistics program managers, logistics element managers, and logistics engineers and analysts. The logistics program manager is the integrator and is supported by the element managers and other technical specialists. While all of these must receive proper education and training, it is the logistic program manager who is of primary concern.

The logistics program managers must receive a very broad education to be effective. The topics that must be covered include the following: systems acquisition process, budgeting and financial management, systems engineering, field/fleet operational requirements, system operation, maintenance systems, management information systems, and logistics integration and management. There are things that a logistics program manager should not be taught; these include the detailed "how to" courses in the various logistics elements.

In addition to learning topics listed above, the logistics program managers must learn to communicate. As can be extrapolated from the data flows depicted in Figure 2, individuals involved in the logistic support system must communicate with each other. The managers must not only know what has to be done and who must do it, but how to communicate with those people. The logistics managers are not the doers in the same sense that the field/fleet logisticians are. They must know what has to be done and how to direct other logisticians to do the work.

FIGURE 2. SOME OF THE COMPLEXITY IN THE RAPIDLY CHANGING OPERATIONAL SUPPORT ENVIRONMENT



With all this in mind, we must now design an education program for logistics program managers. Some portions of this education program can be accommodated by university credit courses and continuing education courses. Systems engineering and management information systems would lend themselves to this approach. Some topics, such as systems acquisition, budgeting and financial management, and logistics integration and management, can be addressed by DOD schools such as the *Defense Systems Management College*. The other topics are best left to schools set up by the services or the individual acquisition commands. The following paragraphs highlight this education program.

Systems Acquisition Process. The systems acquisition process is the start of the acquisition command logistics program manager education program. This involves the Defense Acquisition Board and the services' systems acquisition review process, and the service, DOD, and congressional budget cycles. Even for out-of-production systems, the logistics program manager must know how the weapon

systems acquisition works. This portion of the education program should include a discussion of DOD, service, and command logistics support policy.

Budgeting and Financial Management. As, in some commands, the logistics program managers move further from the technical and logistics aspects of the program, they will have more budget responsibility thrust upon them. They must be taught the DOD Planning, Programming, and Budgeting System. They must learn how to prepare the logistics portion of the program offices' annual budget submission. They must learn how their command handles its funding documents with other offices in the command, field activities, and commercial suppliers.

Systems Engineering. Systems engineering should be taught to provide a framework for all the technical topics that the logistics program manager will have to learn. An appropriate overview of systems engineering for logisticians would cover systems engineering management, including work breakdown structure development and use; system definition, including a look at func-

tional analysis and resource allocation; configuration management and specification generation; technical performance achievement, including risk analysis and management and technical performance measurement; and operational feasibility, including specialty engineering integration, system effectiveness, life-cycle cost and design-to-cost, logistics and the logistic support analysis process, modification management, and manufacturing and producibility.

Field/Fleet Operational Requirements. To help the logistics program manager put the support in perspective, the manager must be familiar with the combat forces' operational requirements. For the managers who support major systems such as aircraft, missiles, or ships, this could be critical in understanding how to provide support. Other logistics program managers have to know the environment in which their system must operate. This portion of the education program is background, and is essential to putting system operation and maintenance system operation in perspective.

System Operation. This portion of the education program does not have to be a formal course. The managers must be familiarized with the system(s) they are supporting. They should have an understanding of the manufacturing process of the system. As with most of the things that the logistics program manager must learn, the manager does not need to be an expert. The manager does not need to be an operator or maintainer, but must be familiar with both the operation and maintenance of the system.

Maintenance System Operation. A course in maintenance system operation is different from a familiarization with the maintenance of the supported system. There should be a course to teach the logistics program managers how the maintenance system works. This involves teaching the managers such things as the capabilities of the different levels of repair, operations of the repair facilities, and operations of the supply system. This could include teaching about such systems as

ment; it could also include teaching how to use the output of these systems.

Management Information Systems. One of the most rapidly growing areas of logistic support is management information systems and other automated analytical tools. The managers must be taught how to use the automated information systems and other tools that are available within the command. Since data must flow between all participants (see Figure 2), managers must learn how to provide information to others and how to use information coming in. In addition to teaching managers how to use the automated tools, they must be taught to make the systems useful to the logisticians and technicians in the field so that the required data will be entered.

Logistics Integration and Management. After discussing seven major topics in a logistics program manager education program, it seems only right to conclude with a discussion of logistics integration and management. This overview would cover the logistics elements and an approach to integrating them into a coherent support program. The overview of the logistics elements would cover maintenance planning and its relationship to operational readiness or sustainability requirements; reliability including differences between specified, demonstrated, and operational reliability; maintainability, including quantification and demonstration; life-cycle cost; logistic support analysis including the process, maintainability-reliability-maintenance engineering design interface, and use of reliability-centered maintenance analysis; repair-level decisions; facilities; packaging, handling, storage, and transportation; funding considerations; technical publications including the processes of generating particular classes of publications from particular kinds of analyses; support and test equipment including selection, design, fabrication, and test; manpower and personnel including analysis and procedures for establishing and evaluating personnel requirements; training and training equipment including analysis of training requirements and development of equipment consistent with system

design and system support concepts; supply support including application of operational mean time between unscheduled removal and logistic support analysis to spares selection and distribution; data including automated maintenance and supply data systems; and warranties including concept of warranty and purposes of a warranty program. There is some duplication and overlapping in this program, but this is necessary to provide some cohesion to the various topics.

The only thing that cannot be taught is communication. The managers will be taught who has to do what to get the job done, but they cannot be taught how to deal with people.

This is an ambitious educational program for logistics program managers. All this may seem too much for a logistician to need to know, but the logistics program manager has many documents to review and evaluate and all these topics are going to be in them. Much of this education must be provided before a logistician can effectively manage a logistics program. All the topics are dynamic and the manager must constantly read and take courses to keep up. This, coupled with the work load of the logistics program manager, can consume the manager's time. Since the manager must manage and not do the detail work, the manager cannot afford to take the time to learn the detailed procedures of the logistics elements.

Summary

To aid in achieving a higher level of readiness in the combat forces, we have focused on creating a "smart logistics manager." This smart logistics manager is the acquisition command logistics program manager.

Ideally, there should be three steps to achieve this goal of smart logistics managers. These three steps are:

—A DOD-wide approach to the logistic policies that is tailored by the services and, finally, by the acquisition commands

—A training program for the field/fleet logisticians, one that also teaches them what to expect from the acquisition logisticians

—An education program for the acquisition logistics program manager.

If the first step is not achieved, the approach will still work. If the second step is not achieved, the approach is less effective, but will still provide measurable results.

The keys to a logistics program manager's education program are:

—Teach managers what has to be done and who must do it

—Teach managers to manage and not to do

—Teach managers a very broad range of topics so they will learn how to integrate all elements of logistics.

The range of topics includes the following:

—Systems Acquisition Process, including Logistics Policy

—Budgeting and Financial Management

—Systems Engineering

—Field/Fleet Operational Requirements

—System Operation

—Maintenance System Operation

—Management Information Systems and Other Automated Analytical Tools

—Logistics Integration and Management.

To achieve an increase in systems readiness, we must establish a clear logistic support policy and teach logisticians how to implement it. In particular, acquisition command logistics program managers must be taught a broad range of background and supporting material and, more importantly, be taught to manage, not to do.

Bibliography

1. Department of Defense (OASD (MRA&L)), "Long-Range Logistics Plan," October 1983.

2. Naval Air Systems Command, "Logistics System Process Specification, AL-082AA-LPS-080, Logistics Integration/Management."

3. Naval Air Systems Command, "Logistics System Process Specification, AL-082AA-LPS-130, Management Information Systems."

4. Naval Air Systems Command, "Logistics System Process Specification, AL-082AA-LPS-160, Training."

5. *System Engineering Management Guide*, Defense Systems Management College, 1983.

Michael E. Harris has been a practicing logistician for more than 17 years and specializes in project management, software life-cycle management, and configuration management. He is with Information Spectrum, Inc., as a program manager in support of Naval Air Systems Command logistics management programs, and has presented papers at six Society of Logistics Engineers symposia.

STATEMENT REQUIRED BY THE ACT OF AUGUST 12, 1970, SECTION 3685, TITLE 39, UNITED STATES CODE, SHOWING THE OWNERSHIP, MANAGEMENT, AND CIRCULATION OF

Program Manager, published bimonthly at the Defense Systems Management College, Fort Belvoir, VA 22060-5426. Number of issues published annually: 6. The Director of Publications is Robert W. Ball, Defense Systems Management College, DRI-P, Fort Belvoir, VA 22060-5426. The Managing Editor is Catherine M. Clark, Defense Systems Management College, DRI-P, Fort Belvoir, VA 22060-5426. The publisher is the Defense Systems Management College, Fort Belvoir, VA 22060-5426.

The average number of copies each issue during the preceding 12 months:

A. Total number of copies printed (net press run): 10,336

B. Paid and/or requested circulation
1. Sales through dealers and carriers, street vendors, and counter sales: None
2. Mail subscriptions paid and/or requested: 9,080

C. Total paid and/or requested circulation: 9,080

D. Free distribution by mail, carrier, or other means, samples, complimentary, and other free copies: 1,180

E. Total distribution: 10,260

F. Copies not distributed

1. Office use, left over, unaccounted, spoiled after printing: 76

2. Returns from news agents: None

G. Total distribution: 10,336

The actual number of copies of single issue published nearest to filing date:

A. Total number of copies printed (net press run): 11,000

B. Paid and/or requested circulation
1. Sales through dealers and carriers, street vendors, and counter sales: None
2. Mail subscriptions: (paid and/or requested): 9,785

C. Total paid and/or requested circulation: 9,785

D. Free distribution by mail carrier, or other means, samples, complimentary, and other free copies: 1,180

E. Total distribution: 10,965

F. Copies not distributed

1. Office use, left over, unaccounted, spoiled after printing: 35

2. Returns from news agents: None

G. Total distribution: 11,000

LARGEST DSMC CORRESPONDENCE CLASS IS AN OUTSTANDING SUCCESS



The Allegany Ballistics Laboratory of Hercules (ABL) and the Defense Systems Management College honored 176 Hercules employees and 2 Defense Contract Audit Agency representatives for completing the Contractor Performance Measurement Course. Pictured at the ceremony at ABL Sept. 6 are: R.E. Heltzel, ABL Vice President and Resident Manager; Lt. Col. Steve Gillespie, USAF, DSMC Professor; Maj. Gen. Lynn H. Stevens, USA, DSMC Commandant; John C. Marvin, ABL; Dr. Anthony Webster and Dr. Michael Judd, DSMC Professors; and Lt. Col. K.E. Nettle, USA, DSMC Executive Officer.

Major General Lynn H. Stevens, USA, Commandant of the Defense Systems Management College (DSMC), was the honor guest at an awards ceremony at the Hercules/Allegany Ballistics Laboratory (ABL), Rocket Center, West Virginia. He recognized 176 Hercules employees and two Defense Contract Audit Agency representatives for completing the Contractor Performance Measurement Course.

Robert E. Heltzel, Vice President and Resident Manager of Hercules/ABL, presented General Stevens with a plaque in appreciation of DSMC support for "providing excellent CPMC/SCSC-C/SSR study materials and DSMC staff support in a timely and cost effective manner" to the Allegany Ballistics Laboratory of the Missiles, Ordnance & Space Group of Hercules Incorporated.

General Stevens and Mr. Heltzel congratulated and presented each candidate with a framed certificate of completion. The general commended Hercules for offering the class to employees and taking the first step in preparing to receive validation of its management control system. "This

is the largest group ever to be graduated from this course at a single time," General Stevens said. He added that "of all of the 3,200 graduates to date, ABL's final exam scores were within the top ten percent," and noted that success of the class could be the direct result of Hercules' top-management involvement and commitment. In addition to professional staff, the Hercules class comprised executive managers, division managers, department managers and department supervisors in all key functional areas.

Post-ceremony activities included a plant tour for General Stevens and other DSMC guests. Dr. Anthony Webster and Dr. Michael Judd, DSMC Professors, discussed with John Marvin, Hercules course instructor, how training aids generated by DSMC could be used more effectively for/by industry trainers. Mr. Marvin said improvements in DOD industry can occur principally because of knowledgeable people and managers; and DSMC should offer more of its curriculum as self-study, self-paced correspondence courses to enable busy DOD industry professionals to increase their knowledge cost-effectively without missing work.



ETHICS: CAN WE GET A GRIP ON OURSELVES?

Do Adequate Constraints Exist to Deter Defense Acquisition People from Violating the Code?

Wilbur D. Jones, Jr.

Predictably, the year 1988 has brought a leap day, the Olympics and a presidential election, so far without catastrophe. For the defense acquisition community, it has been an entirely different matter. Unpredictably, it has been the year of the painfully embarrassing alleged procurement scandal.

Ethically, were we ready for it?

To us in defense acquisition, trying hard to hold a steady hand to the wheel of the acquisition process following a succession of test-analyze-and-fix remedies in recent years, one nagging question remains: How did we prepare for the prospect that this could happen?

Is it our nature to sign off hurriedly on a route slip without reading the most recent directive or Inspector General investigation? Do we retain copies for later reference?

At the least, when was the last time you attended a briefing on government or corporate ethics, standards of conduct, or read the posters on bulletin boards? Were you directed to do so, or did you do so voluntarily?

Look around. Department of Defense ethics prevention and deterrence efforts are under intense fire. Critics abound in the media, the Congress and among ourselves. What are we critiquing? What limits are justified? Perhaps this essay will help you gain insight by examining some of the ethics issues we face.

I'm not talking about the ten-dollar limit on contractor logoed coffee-cup gratuities, or the colonel's free lunch in the assembly plant cafeteria. I'm talking about a serious and potentially calamitous situation with severe repercussions on current and future weapon system programs needed for national security.

"There they go again!" trumpet defense detractors, with more impetus for reform. Americans, caught somewhere between "they're a bunch of crooks" and "it's an issue of human frailty and not the system," are bound to be confused and upset.

The public esteem, support and trust we rebuilt after the spare parts, hammers and other public relations wounds 4-6 years ago are in jeopardy. Our self confidence is shaken. Time and energy are being drained from productive use to cleanup. The fallout is indeterminable, but frightening.

At this writing, the investigations continue. Public allegations remain to be entered into the judicial process. *Nevertheless, neither the painful scandalous facts nor ethical issues raised are driving points of this essay, albeit the lightning rod. The point is whether enough action has been taken to preclude these kinds of things from taking place.*

Let's tempt ourselves with a hypothetical case. We are in industry or government and have the probability of personal gain, large or small, which breaches the law or *Code of Conduct*.

**Sentence of a Contractor who Tried to Cheat
the Government.**

ADJUTANT GENERAL'S OFFICE, }
WASHINGTON, November 21. }

John K. Stetler has been convicted, by court-martial, of wilful neglect of duty, in having contracted to furnish to the Subsistence Department one hundred thousand pounds of prime roasted and ground Rio coffee, stipulating in the contract that proof by chemical analyzation, or otherwise, should show said coffee to be composed wholly of pure prime Rio coffee, and that the same should be delivered in Baltimore. In failing to deliver any amount whatever of pure primo Rio coffee, and having agreed to furnish to the United States about one hundred casks of pure prime roasted and ground Rio coffee; he did deliver instead thereof about one hundred casks of coffee, proved by inspection and chemical analysis to be impure and adulterated with foreign substances, and which was therefore rejected by the Subsistence Department, the court sentenced said John K. Stetler to be imprisoned in the penitentiary at Albany, New York, or at such other place as the Secretary of War may direct, for the term of five years. The foregoing sentence has been approved by the Secretary of War, and Albany, New York, designated as the place of confinement, which has been approved by the President.

E. D. TOWNSEND, Asst. Adj. Gen.

Point: Are there preventive incentives (deterrents) to our acting for personal gain?

Point: Are we aware of the laws, standards and regulations, their mores and shall-nots, against which we would be measured?

Point: Are we aware of the consequences of violations?

Point: If yes, would our comprehension and awareness deter us? Would our personal morals? If not, what would?

As we survey these issues, our frame of reference is the existence, or non-existence, of "adequate constraints" on our behavior. If inadequate, would the temptation to deviate desist with the imposition of more? Can every potential situation be anticipated and covered? If adequate, should we say: "Enough, we will work with what we have!"

Point: Within this frame of reference, should constraints be institutional, personal or both?

An Array of Boundaries

Every day, the Department of Defense (DOD) awakens to some 57 laws and regulations governing principal conflicts-of-interest rules and matters of ethics and conduct. This includes two Executive Orders of the President, 26 citations from the United States Code (U.S.C.), or laws, four other public laws, three DOD directives, one directive each for the three military services, 14 regulations from the Federal Acquisition Regulation (FAR) and its Defense Supplement, and five other citations. Additionally, the Defense Inspector General issued 25 "alert and beware" handbooks on ethics and conduct, including 14 on acquisition. Posters displaying the *Code of Conduct* and the Fraud, Waste and Abuse Hotline are everywhere.

The DOD has gone so far as to publish a handbook specifically for the acquisition community titled *Acquisition Alerts for Program Managers* for which the Defense Systems Management College (DSMC) collaborated

with the Defense Inspector General. Lessons on ethics are taught to military officers and civilian officials at several DOD institutions of higher learning including DSMC and the National Defense University.

Figures 1, 2 and 3 tell the story. With this array of boundaries, ignorance of ethics and conduct is naive and incredulous.

Prevention of Fraud and Waste

Based on current procurement-scandal allegations, and for the thrust of this essay, I will use more specific words "fraud" and "waste" rather than "ethics" and "conduct." In this context, the "buyer" with the need is a defense contractor. The "seller" with the information the contractor needs is a DOD employee.

Who is responsible for preventing fraud and waste in defense acquisition? According to June Gibbs Brown, Defense Inspector General, in testimony before the House Committee on Government Operations, the responsibility is shared by corporate management officials, DOD procurement officials, the Defense Inspector General and the Congress.¹ In referring to her own enforcement means, Ms. Gibbs states: "If corporate officials do not recognize this responsibility and take appropriate action, no number of auditors, inspectors and investigators will have a measurable impact upon reducing fraud and waste in defense programs."²

How do procurement officials prevent fraud and waste and enforce laws and regulations? According to Dr. Robert B. Costello, Under Secretary of Defense (Acquisition), in congressional testimony regarding contractual courses of action, "While all of these (contractual) remedies are available to us, we should recognize that there is no way to legislate greed out of existence. It is unlikely that persons willing to give or receive bribes will be deterred by signing certificates. Rather, we must insist on a moral climate within which bribery is unacceptable behavior; and the system of investigation and enforcement ensures persons tendering or receiving bribes will be identified and punished."³

Ms. Brown further states the Inspector General "will always aggressively seek out waste and vigorously investigate criminal activities," in addition to a commitment to prevention efforts and working with the many ethical contractors.⁴

How do corporate management officials prevent fraud and waste? According to the Defense Industry Initiatives on Business Ethics and Conduct, it must be through top-management attention to ethics, training, reporting alleged misconduct, responsibility to their industry, public accountability and its own policing, called self-governance.⁵

How does the Congress prevent fraud and waste? Figures 1 and 2 portray part of the answer: through legislation establishing what cannot be done and prescribing penalties for violations. The rest of the answer is through congressional oversight and its publicity, and the resultant hue and cry for both retribution and reform, and through support of "whistle blowers" reporting alleged misconduct.

DOD Directive 5500.7

A discussion of applicable laws and regulations must begin with DOD Directive 5500.7, "Standards of Conduct," of May 6, 1987. The directive addresses nearly everything you would need to know and is an essential reference. It applies to former DOD civilian officials and retired military officers and current DOD employees. It states:

DOD personnel shall become familiar with the scope of, authority for, and limitations of the activities for which they are responsible...shall acquire a working knowledge of appropriate statutory standards of conduct prohibitions and restrictions...which include conflict of interest laws, (and) general post employment restrictions....

The directive has a *Digest of Laws* summarizing those pertaining to conflict of interest, post-government service, laws applicable to retired regular officers, and other applicable laws.

FIGURE 1. TABLE OF PRINCIPAL CONFLICTS OF INTEREST RULES

RULE CITE	TYPE RULE & DURATION	ACTIVITY PROHIBITED	PERSONS TO WHICH PROVISIONS APPLY	PENALTY OR REMEDY	NOTES
APPLICABLE TO CURRENT DOD PERSONNEL					
Agency Regulations (e.g. 49 CFR 99.735.9 for DOT personnel)	Civil and Administrative ...applies throughout employment or service	1. Permitting the prospect of employment to affect performance of duties 2. Communication information of particular interest to a prospective employer (even if that information is generally available to the general public)	All employees (includes active duty military where applicable)	Adverse or disciplinary action (for military personnel criminal action under UCMJ could result)	
18 U.S.C. 201	Criminal ...applies throughout employment	Offering, giving, accepting, or requesting something of value to influence an official act	All employees	Fine and 15 years imprisonment	
18 U.S.C. 203	Criminal ...applies throughout employment or service	1. Accepting compensation from unofficial sources for outside work related to any particular matters in which U.S. has direct or substantial interest 2. Accepting unofficial compensation for official duties	All full-time employees	\$10,000 fine and 2 years imprisonment. Permanent ban or employment with U.S.	5
18 U.S.C. 208	Criminal ...applies throughout employment or service	Participating in a particular matter involving a firm with which the employee or family member of employee 1. Is negotiating 2. Has an arrangement regarding future employment 3. Has other financial interests	All officers of the uniformed services and civilian employees (does not apply to enlisted personnel of the uniformed services)	\$10,000 fine and 2 years imprisonment	1

10 U.S.C. 2397a	Civil and Administrative ... applies throughout employment or service	Affirmative requirement to:	Covered defense officials, i.e.	10 year ban on employment with that defense contractor. \$10,000 civil penalty. Additional \$10,000 penalty if employment accepted	2,4
		1. Report employment contact to the supervisor and the DAEO or designee, and	1. Active duty military officers 0-4 and above and civilian DOD personnel paid at or above GS-11 who		
		2. To disqualify themselves from all participation in the performance of any procurement function relating to any contacts of that defense contractor for as long as future employment opportunities have not been rejected	2. Have participated in the performance of a procurement function in regard to a contract awarded by DOD		
E.O. 11222 May 8, 1965 & DODD 5500.7, F.3 b	Administrative ... applies throughout employment including the year of termination with government	Affirmative requirement to file a Confidential Statement of Affiliations and Financial Interests DD Form 1555 with supervisor or DAEO or designee	Who are contacted by or contact that defense contractor regarding future employment	Adverse or disciplinary action	
			Except for those who file SF278		
			1. Commanders and deputy commanders or major installations and operations		
			2. Personnel paid at a GS-15 rate or below and military members 0-7 and below who are in a decision making position that could impact on the financial interests of a nonfederal activity		
			3. Special government employees except those named in DODD 5500.7 enclosure 5		
P.L. 95-521 Ethics in Government Act of 1978 & DODD 5500.7, F.3 a	Civil and Administrative ... applies throughout employment and must file last report no later than 30 days after termination with government	Affirmative requirement to file a Financial Disclosure Report SF 278 with the DOD Component. Reports are available for public review	1. General and Flag officers 0-7 and above	Adverse or disciplinary action, \$5,000 penalty	
			2. SES and GS-16 above		
			3. Other than GS personnel who are paid as GS-16 or above		
			4. Schedule C employees unless excluded by the Director of OGE		

CAUTION: This is a SUMMARY of the rules. Refer to cited statute or regulation for complete information
Source: Office of General Counsel, DOD

U.S.C. (Laws)

In recent years, congressional concern with government ethics has centered on the "revolving door," the tendency of DOD employees to leave government service and join defense contractors, and of industry officials to enter government service for a short time and then return to industry. The Congress has discerned a high potential for actual, or perceived, conflicts of interest and other improprieties and has acted accordingly. Of particular note is legislation to curtail post-government employment. These include the following.

10 U.S.C. 2397. The first section applies to former DOD employees: (1) retired military officers or former military officers who served on active duty at least 10 years at the grade of 0-4 or higher, and former civilian employees who served at a GS-13 pay rate or higher; (2) who, within two years of leaving DOD, are employed by defense contractors awarded at least \$10 million in defense contracts, and (3) received \$25,000 or more annually in compensation from that contractor.

The second section applies to present DOD employees: (1) civilian employees GS-13 or higher, (2) who, within two years prior to beginning with the DOD component (service, defense agency, Office of the Secretary of Defense, etc.) were employed by a defense contractor awarded at least \$10 million in DOD contracts, and (3) received \$25,000 or more in compensation from that contractor.

These above individuals shall file reports (DD Form 1787) giving their name and address, the name and address of the defense contractor, a description of their duties, a description of their duties with DOD and other information. The penalty for failure to file is a fine up to \$10,000.

Section 2397a requires a like report to be filed by individuals when they discuss jobs with defense contractors.

This part of the Code reflects language in the FY 1987 DOD Authorization Act (Public Law 99-661), updated by P.L. 100-26.

10 U.S.C. 2397b. Applies to former DOD employees at GS-13 or higher or 0-4 or higher who (1) spent the majority of their working days during the last two years of DOD service performing procurement related functions related to a defense contract at a site or plant that was owned or operated by the contractor, and that was the principal location of performance of such duties, or (2) spent the majority of their working days during the last two years of DOD service performing personally and substantially in a decision-making capacity through contact with a contractor on a major defense system.

The law also restricts former employees in the Senior Executive Service or 0-7 or higher who performed duties as a primary representative of the United States while either negotiating a defense contract or settling a contractor's claim of a least \$10 million. The penalty is a fine up to \$250,000.

The core of this part of the Code and for 2397c which follows comprised three laws, P.L. 99-500, P.L. 591 and P.L. 99-661.

10 U.S.C. 2397c. This requires a defense contractor to file a report on former DOD employees who have been out of government for less than two years. The report is parallel to that prescribed in 2397.

Other principal Code citations referring to conflict of interest include: 18 U.S.C. 203, 205, 208 and 209. Other principal citations referring to post-government service include 18 U.S.C. 203, 207, 281, 283, and 37 U.S.C. 801(b) as amended.

Contemporary Applications

The procurement scandal has placed attention on conditions covered in the *Code of Ethics for Government Ser-*

Mr. Jones, a Professor of systems acquisition management in the Policy and Organization Management Department at the Defense Systems Management College, recently completed an extended assignment in the Pentagon as speech writer for the Under Secretary of Defense (Acquisition).

FIGURE 1. TABLE OF PRINCIPAL CONFLICTS OF INTEREST RULES (CONTINUED)

RULE CITE	TYPE RULE CITE	ACTIVITY PROHIBITED	PERSONS TO WHICH PROVISIONS APPLY	PENALTY OR REMEDY	NOTES
APPLICABLE TO FORMER DOD PERSONNEL					
SELLING					
37 U.S.C. 801(b)	Civil ...applies for 3 years from date name placed on retired list	Engaging in selling supplies or war materials to an agency of the DOD, the Coast Guard, PHS, or NOAA	Officers on the retired list of the Regular Army, Regular Navy, Regular Marine Corps, Regular Air Force, Regular Coast Guard, PHS and NOAA	Prohibition from receiving any payment from any appropriation (including retired pay)	4
18 U.S.C. 281(a)	Criminal applies for 2 years	Representing anyone in the sale of anything to the government through the department in whose service retired status is held	Retired officer of the armed forces	\$250,000 fine, 2 years imprisonment and loss of right to hold federal office	
REPRESENTING					
18 U.S.C. 207(a)	Criminal applies for life	1. Knowingly acting as agent or attorney or representing any other person by a. any formal or informal appearance before the government, or b. making any oral or written communication on behalf of that person with intent to influence a particular matter 2. In connection with a particular matter involving specific parties, of which the government is a party or has a direct and substantial interest 3. Where employee participated personally and substantially while in government service	All former officers of the uniformed services and all former civilian employees (does not apply to former enlisted personnel of uniformed services)	\$10,000 fine and 2 years imprisonment	

18 U.S.C. 207(b)(1)	Criminal ...applies for 2 years after termination with government	1. Same as above for 18 U.S.C. 207(a) 2. Same as above for 18 U.S.C. 207(a) 3. Which matter was actually pending under the employee's official responsibility within one year prior to termination with the government	Same as for 18 U.S.C. 207(a)
18 U.S.C. 207(b)(2)	Criminal ...applies for 2 years after termination with government	1. Knowingly represents, aids, counsels, advises, consults or assists in representing any other person by formal or informal appearance before the government 2. Same as above for 18 U.S.C. 207(a) 3. Same as above for 18 U.S.C. 207(a)	Former officers and employees 0-9 or GS-17 and above and designated SES 0-7 and 0-8 officers and employees Same as for 18 U.S.C. 207(a)
18 U.S.C. 207(c)	Criminal ...applies for 1 year after termination with government	1. Same as above for 18 U.S.C. 207(a) 2. In connection with any particular matter 3. Which is pending before the department where the individual served or was employed	Same as for 18 U.S.C. 207(b)(2)
18 U.S.C. 281(b)	Criminal ...applies for 2 years after retirement	Acting as agent or attorney for prosecuting or assisting in prosecuting any claim against the United States 1. Involving the department in whose service retired status is held 2. Involving any subject matter with which the individual was directly connected while in an active duty status	Retired officers of the armed forces \$250,000 fine and 1 year imprisonment

CAUTION: This is a SUMMARY of the rules. Refer to cited statute or regulation for complete information

Source: Office of General Counsel, DOD

vice, passed by the Congress and signed by the President in 1980, and the DOD Standards of Conduct.

From the Code of Ethics

Any person in Government service should:

—Never discriminate unfairly by dispensing special favors or privileges to anyone, whether for remuneration or not, and never accept, for himself or herself or for family members, favors or benefits under circumstances which might be construed by reasonable persons as influencing the performance of governmental duties.

—Engage in no business with the Government, either directly or indirectly, which is inconsistent with the conscientious performance of governmental duties.

—Never use any information gained confidentially in the performance of governmental duties as a means of making private profit.

From the Standards of Conduct

—An employee shall not use, for the purpose of furthering a private interest, official information that has not been made available to the general public.

—Consultants, advisors and special government employees shall not use any inside information, obtained as a result of their Government service, for private personal gain either by direct action on their part, by counsel, or by recommendations or suggestions to others, including those with whom they have family, business or financial ties.

Government-Industry Relations

At the heart of acquisition ethics are relations between government and the defense industry, which, in recent years, were becoming increasingly contentious. As Dr. Costello has stated: "Even though the relationship was not in jeopardy, the traditional 'arm's length' relationship has become a gap caused by questionable motivations on both sides, improper ways of doing business, extreme cautiousness and a tendency to overreact to counter both perceptions and realities."⁶

As a result, Dr. Costello made improving relations one of his top 10 strategies for improving defense acquisition when he assumed the position in 1987, saying that "the situation has been out of balance." Dr. Costello continues: "If DOD and industry are to proceed effectively toward common national security objectives, we must restore mutual respect and trust. The key to forging this new relationship is 'balance.' Balance is neither extreme, rather a position somewhere moderately between *laissez-faire* and 'buyer beware,' neither overregulation nor 'hands off.' Balance is a common sense approach."⁷

The DOD began reducing excessive audits and oversight; working on the risk-reward equation regarding the profit a contractor will gain for risk taken under a contract; improving buyer-seller relationships through better communications, listening to industry's concerns, working groups, and the like. This effort, in concert with industry representatives, began to clear the air. Then came the alleged scandal. (Based on public comments, it can be conjectured the alleged improprieties, for the most part, began and took place before this effort to improve relations, the institution of contractor self-governance and the 1986-87 legislative activity regarding "revolving door," et al.)

Industry Self-Governance

Self-governance was strongly recommended by the President's Blue Ribbon (Packard) Commission on Defense Management in 1986:

To assure that their houses are in order, defense contractors must promulgate and vigilantly enforce codes of ethics that address the unique problems and procedures incident to defense procurement. They must develop and implement internal controls to monitor these codes of ethics and sensitive aspects of contract compliance.⁸

Industry accepted the recommendation and formed the Defense Industry Initiatives on Business Ethics and Conduct (DII). Six corporate principles were established for companies

FIGURE 1. TABLE OF PRINCIPAL CONFLICTS OF INTEREST RULES (CONTINUED)

RULE CITE	TYPE RULE & DURATION	ACTIVITY PROHIBITED	PERSONS TO WHICH PROVISIONS APPLY	PENALTY OR REMEDY	NOTES
ACCEPTING EMPLOYMENT					
10 U.S.C. 2397b	Civil ...applies for 2 years after termination with government	1. Accepting employment with a defense contractor with which the individual has acted as a primary representative of the U.S. in negotiating a contract or in a settlement involving a defense contract, in excess of \$10m. 2. Accepting employment with a defense contractor with which the individual performed a. procurement function for the U.S. b. for a majority of working days c. at a site or plant armed or operated by the defense contractor and d. that site was the principal location of performance of the Procurement function 3. Accepting employment from a defense contractor with which the individual performed a. a procurement function for the U.S. b. on a majority of working days c. relating to a major defense system d. involving decision-making responsibilities e. through contact with the contractor	1. Former officers and employees 0-7 or SES and above 2. Former officers and employees 0-4 or GS-13 and above	\$250,000 fine (\$500,000 liquidated damages against contractor)	4

POST EMPLOYMENT REPORTING REQUIREMENT

10 U.S.C. 2397	Civil ...applies for 2 years after termination with government	Affirmative requirement to file a Report of DOD and Defense Related Employment DD Form 1787 when employed at an annual rate of \$25,000 or more with a major defense contractor (which was awarded DOD contracts totaling at least \$10,000,000 during the prior year)	Former DOD personnel 1. Who served in pay grade O-4 or above with ten years active military service 2. Who were civilians paid at a GS-13 rate or higher	\$10,000 administrative penalty	3. 4
37 U.S.C. 801(b) 5 U.S.C. 5532 & DODD 5500.7	Administrative ...applies for 3 years after retirement	Affirmative requirement to file a Statement of Employment Report DD Form 1357 which indicated whether the individual is employed with a defense contractor	Retired regular officers	Withholding retired pay	4

NOTES

1. Penalty can be avoided by notification to supervisor of initial employment contact and cessation of all contact
2. A rebuttable presumption in favor of the covered official that a failure to report or disqualification is not a violation if the DAEO or designee has given a written opinion stating the report or disqualification is unnecessary
3. A virtually identical provision works in reverse and applies to employees or consultants to DOD who within 2 years were employed or consultants to major defense contractors
4. These rules apply only to current or former Department of Defense officers and employees
5. Temporary and part-time employees (e.g., consultants) may accept compensation for outside work in which the U.S. has an interest if the matter is unrelated to the consultant's official duties

CAUTION: This is a SUMMARY of the rules. Refer to cited statute or regulation for complete information

Source: Office of General Counsel, DOD

signing up. Each company agrees to abide by the principles and agrees it has implemented, or will implement, management policies.

The principles are as follows.

— The company will have and adhere to a written code of business ethics and conduct, and will train employees in the code.

— The company's code establishes the high value expected of employees and standards against which they are judged.

— The company will create a free and open atmosphere allowing and encouraging employees to report code violations without fear of retribution.

— The company has an obligation to self-govern by monitoring compliance with federal procurement laws and voluntary disclosure of violations and actions taken.

— The company is responsible to other companies in industry to live by the standards of conduct and preserve the integrity of the defense industry.

— The company must have public accountability for its commitment to these principles.⁹

Because government does not have the resources or tools to live inside every company and monitor every activity, industry must monitor itself. It is in industry's best interests to improve its image and do what is right in the first place.¹⁰

As of July 1988, 46 defense contractors had signed up, many of them at the level of Boeing, FMC, General Dynamics and Honeywell. How many others have initiated similar actions is unknown. The DII is not a government program.

A key ingredient in DII is the voluntary disclosure provision, under which a contractor voluntarily provides to the government information obtained regarding its own potential fraud or misconduct in a contractual relationship. To DOD, disclosure coupled with contractor cooperation and corrective action, are strong indications of contractor integrity.¹¹ Furthermore, where voluntary disclosure has not occurred, but where a contractor is confronted with a

government-identified allegation of fraud, and agrees to cooperate, make restitution and undertake corrective action, DOD will consider these efforts as part of the contractor's commitment toward corporate integrity when determinations concerning suspensions and debarments are made.¹²

Can self-governance work? Will congressional and public pressure give it enough time to try? It does not help that of the 46 companies, 39 were under investigation in July 1988, and 25 of them were being investigated after having signed up.

Individual Morality Issue

According to Morris B. Silverstein, Assistant Defense Inspector General for Criminal Investigations, Policy and Oversight, a government employee who would violate the law or regulations perhaps can be characterized. Employees who would breach their fiduciary duty and take actions harmful to government interests are less likely to be aggressive in dealings with a contractor, or as professional in their jobs as they are supposed to be. That type of employee might be aware of violations, but it is easier to go along rather than blow the whistle. The attitude may be one of "I got the job done so we saved the government money in the long run."¹³

How does this type of personal morality affect government long-term interests? The answer may be contained in this statement by Mr. Silverstein:

What about other contractors, potential competitors, and whether they enter the field to do business with the government? They may feel it is not worth spending money and developing expertise since the other guys have the relationship.¹⁴

If there are adequate laws and regulations, and if they are adhered to by almost everyone in defense acquisition, where are the gaps? One thought being advanced is that we may not be reaching the right level of DOD people with the message of ethics and conduct; that the average mid-to-low-level employee takes it seriously, but

FIGURE 2. OTHER APPLICABLE LAWS AND REGULATIONS

The Anti-Deficiency Act (Using Appropriated Funds)	31 U.S.C. 1301; 31 U.S.C. 1341, 1517
The Anti-Kickback Act	41 U.S.C. 51-58
The Buy American Act	41 U.S.C. 10, E.O. 10582; and FAR Parts 25-1 and 25-2
The Brooks Act	Public Law 89-306; 40 U.S.C. 759; FAR Part 70
The Changes Clause	FAR Part 43
The Competition in Contracting Act	PL 98-369; FAR Part 6
The Consolidated List of Debarred, Suspended, and Ineligible Contractors	FAR Subpart 9.4
Employment Restrictions on Certain Former DOD Officials	DOD Directive 5500.7
Inspection and Acceptance Clause	FAR Part 46
Liquidated Damages Clause	FAR Part 12.1
Patents	35 U.S.C. 101 and 161 U.S.C. Constitution, Article 1, Section 8, Clause 8
Pre-award Surveys	FAR Subpart 9.1
The Prompt Payment Act	Public Law 97-177
Restrictions Affecting Former Officers and Employees	5 U.S.C. 5305; Army Regulation 600-50; Navy Instruction 5370.2H; Air Force Regulation 30-30; DOD Directives 7700.15 and 1402.1
Special Promotional Programs	63 COMPGEN 229 (1984); 59 COMPGEN 203 (1980); JTR Vol 2
Specifications	FAR Part 10
Standards of Conduct and Conflicts of Interest	5 C.F.R. 735; 18 U.S.C. 202; 2 U.S.C. 441i; 18 U.S.C. 5209; DOD Directive 5500.7
The Small Business Act	10 U.S.C. 2304; 15 U.S.C. 631-647; FAR Part 19
Termination for Convenience	FAR Part 49
Termination for Default	FAR Part 49
Unauthorized Commitments	DFAR Supplement 1.670
Unsolicited Proposals	FAR Subpart 15.5
Warranties	FAR Part 46.7

Source: Pamphlet IG, DOD 4245.1-H

FIGURE 3. INSPECTOR GENERAL AND OTHER RELATED PUBLICATIONS

THESE HANDBOOKS ALERT YOU TO POTENTIAL PROBLEMS WHEN DEALING WITH SPECIFIC ACQUISITION AREAS.

Acquisition Alerts for Program Managers, September 1987. IG, DOD 4245.1-H
Indicators of Fraud in Department of Defense Procurement, August 1987
Handbook on Labor Fraud Indicators, August 1985
Handbook on Fraud Indicators: Material, July 1985
Handbook on Scenarios of Potential Defective Pricing Fraud, IG 7600 1-H, December 1986
Federal Acquisition Regulations Which Encourage Timely Contractor Negotiations Pursuant to Audit Report Recommendations, March 1987
Report on Gratuities and Standards of Conduct Relating to DOD Procurement, IG/DOD 5500.2-H, February 23, 1987
Computers: Crimes, Clues and Controls, March 1986
Antitrust Enforcement in DOD Procurement, IG 5505.1-H, January 1987
Fraud Awareness Concepts for Department of Defense Quality Assurance Personnel, May 1985
Report on Suspension and Debarment Activity Within the Air Force, IG, DOD Office of Criminal Investigation and Oversight 88FDH012, C1PO, April 29, 1988
Criminal Defective Pricing and the Truth in Negotiations Act, IG, DOD IGDPH 4200.50, C1PO, March 1988
Review of Significant Product Substitution Cases Within the Department of Defense, IG, DOD 7050.1-R, September 1987

THE FOLLOWING HANDBOOKS PROVIDE INFORMATION ON AREAS NOT SPECIFICALLY RELATED TO ACQUISITION:

Audit Followup Practices in the Federal Government, January 1987
Summary Report on Audit of Government Property in the Possession of Contractors/Grantees, August 1983
Compendium of Advanced Audit Techniques, August 1985
Guide for External Quality Assurance Reviews of Internal Audit Organizations, September 1985
Review of Suspension and Debarment Activities within the Department of Defense, May 1984 (Available Only to DOD Activities)
Guidelines for Civil Fraud Remedies and Parallel Proceedings, September 1985
Civilian Payroll Operation Areas Most Susceptible to Fraud, Waste and Abuse—Audit Guides, September 1982
Integrity Alerts... Common Pitfalls and Everyday Ethics..., October 1986
How to Keep Out of Trouble... Ethical Conduct for Federal Employees... in Brief, January 1986
Allocating Audit Resources Through Operations Risk Analysis—A Methodology, 1985
Use of Technical Experts by Inspector General Organizations, October 1985
Inspector General Subpoenas, Published by the Criminal and Civil Divisions, U.S. Department of Justice, July 1987
Guidelines for Civil Fraud Remedies and Parallel Proceedings, President's Council on Integrity and Efficiency, September 27, 1985

You may obtain copies of these handbooks by writing to the
Inspector General, Department of Defense, Program Planning,
Review and Management (Analysis and Reports), Room 950,
400 Army Navy Drive, Arlington, VA, 22202-2884

Source: Pamphlet IG, DOD 4245.1-H

How would such an effort fit with today's perceived public morality? Some would argue what we are seeing in the alleged procurement scandal is cause and effect, indicative of and a product of the times. If we are serious about this concept, would we be swimming upstream?

More Rules to Live By?

What conclusions can we draw? Do we need more guidelines? Hear the words of Secretary of Defense Frank C. Carlucci in congressional testimony in July 1988 regarding the alleged procurement scandal. First, before the Senate Armed Services Committee:

Defense acquisition is already too complex. Adding more provisions and prohibitions could be counter-productive, especially if underlying causes go untreated. No amount of rule-making can eliminate rule-breaking. Unnecessary complexity wastes time, money and energy.¹⁵

Later, before the House Armed Services Committee:

We have underway a review of existing laws and regulations covering those illegal or improper actions disclosed by the investigation. Where our analysis discloses that corrective action should be taken, we will do so. Corrective action may include proposals to the Congress for legislation or revision to Federal Acquisition Regulation.¹⁶

Mr. Carlucci added that FAR changes have been identified regarding consultants working for DOD which would ensure they were not placed in a conflict of interest role because of work they are doing for private firms.¹⁷

Call the Hotline

The DOD Hotline for reporting fraud, waste and abuse is 223-5080 (Autovon); 800-424-9098 (commercial, toll free); or 693-5080, Washington, DC, area. The address is DOD Hotline, The Pentagon, Washington, DC, 20301.

that those higher up may feel "above it." Military officers, having less exposure in a career to civilians and contractors, live by stern military codes and could be viewed as more cautious and less susceptible.

Should the focus instead be on the individual employee's morals and stan-

dards? Would it be practical and cost-effective to assume such a broad behavioral educational program? Would it be done through counseling, group sessions, films and lectures, religious organizations? This would envision a new concept of employee education.

FIGURE 4. AUDIT ACTIVITY

	FY 82	FY 83	FY 84	FY 85	FY 86	FY 87	FIRST HALF FY 88
AUDIT REPORTS ISSUED							
INTERNAL AUDIT							
IG, DOD	143	170	140	125	138	240	117
Total DOD	20,520	18,467	18,532	17,553	18,183	17,345	7,660
CONTRACT AUDIT							
DCAA	61,627	57,782	61,081	62,078	69,082	65,644	26,376
SAVINGS IDENTIFIED							
INTERNAL AUDIT							
IG, DOD	\$ 1.4b	\$.4b	\$ 1.0b	\$ 1.1b	\$.8b	\$ 1.2b	\$.7b
Total DOD	\$ 2.4b	\$ 1.6b	\$ 2.7b	\$ 2.7b	\$ 5.7b	\$ 3.9b	\$ 1.8b
CONTRACT AUDIT							
DCAA	N/A	N/A	\$ 8.1b	\$ 7.9b	\$ 6.8b	\$ 8.7b	\$ 3.0b

N/A - Information not available
b = billions of dollars

Source: The Honorable June Gibbs Brown, Defense Inspector General, before the Subcommittee on Legislation and National Security, House Committee on Government Operations, July 13, 1988

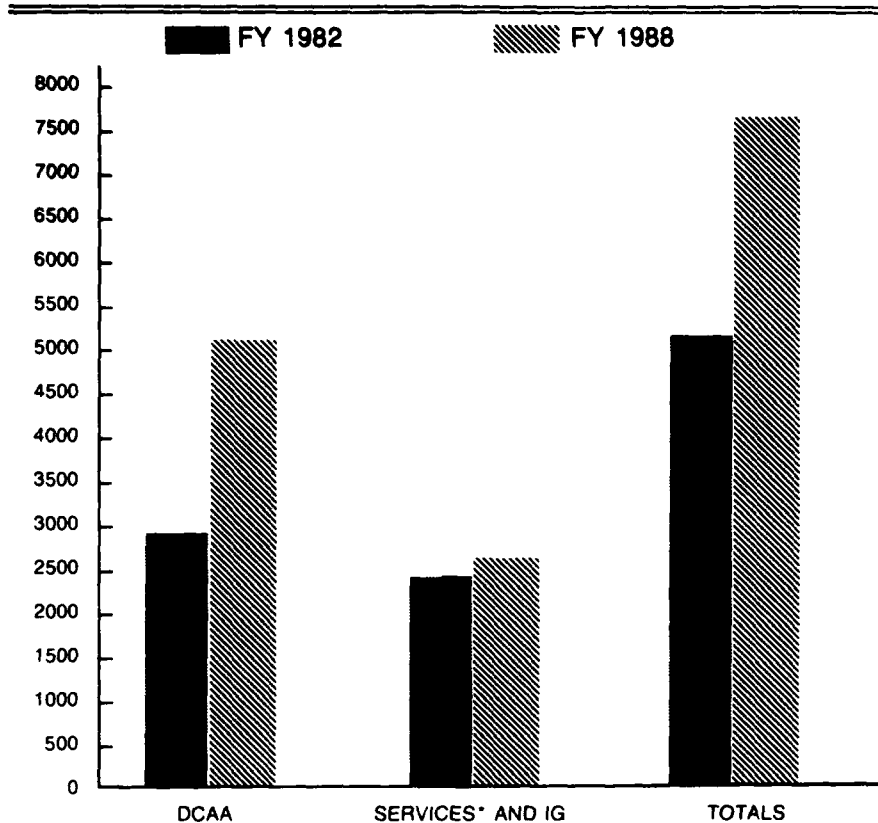
FIGURE 5. INVESTIGATIVE ACTIVITY

	FY 82	FY 83	FY 84	FY 85	FY 86	FY 87	FIRST HALF FY 88
INDICTMENTS (DOJ)*							
DCIS	13	64	81	129	239	476	107
Total DOD	27	108	174	253	308	634	294
CONVICTIONS (DOJ)*							
DCIS	12	57	64	83	168	329	93
Total DOD	102	207	181	256	282	531	244
MONETARY RESULTS							
DCIS	\$ 5.5m	\$ 4.8m	\$ 8.2m	\$ 21.2m	\$ 60.5m	\$119.9m	\$ 52.4m
Total DOD	\$ 13.8m	\$ 14.8m	\$ 29.2m	\$125.9m	\$101.9m	\$199.7m	\$304.9m

* Excludes military courts martial
N/A - Information not available
m = millions of dollars

Source: The Honorable June Gibbs Brown, Defense Inspector General, before the Subcommittee on Legislation and National Security, House Committee on Government Operations, July 13, 1988

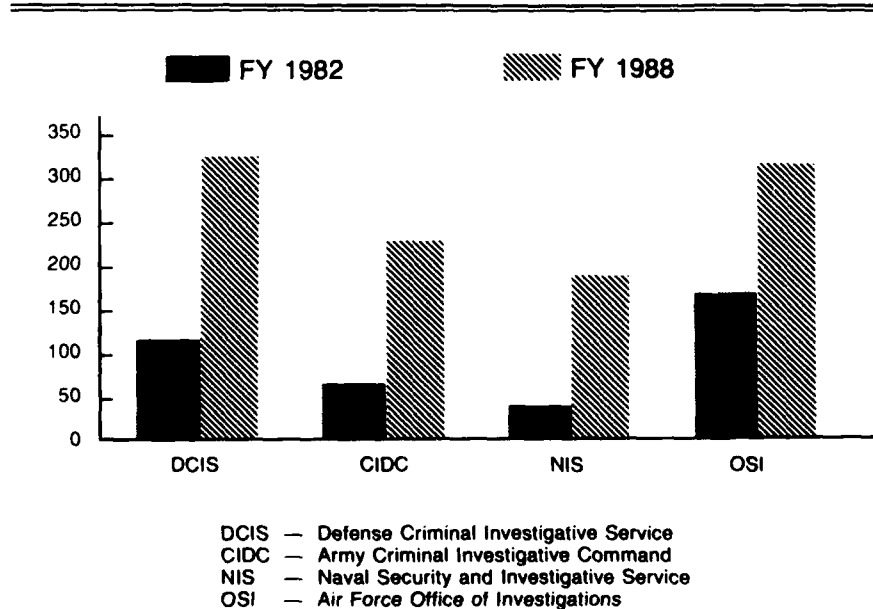
FIGURE 6. AUDITORS



* Includes the Army Audit Agency, the Naval Audit Service, and the Air Force Audit Agency

Source: The Honorable Robert B. Costello, USD(A), before the House Armed Services Committee, June 29, 1988

FIGURE 7. NUMBER OF FRAUD AGENTS WITHIN THE DEPARTMENT OF DEFENSE



Source: The Honorable Robert B. Costello, USD(A), before the House Armed Services Committee, June 29, 1988

Endnotes

1. Statement by The Honorable June Gibbs Brown, Inspector General, Department of Defense, before Subcommittee on Legislation and National Security, House Committee on Government Operations, "Oversight of DOD Procurement Programs," July 13, 1988, pp. 13-14.

2. Ibid, p.14.

3. Statement by The Honorable Robert B. Costello, Under Secretary of Defense (Acquisition), before House Appropriations Committee, July 6, 1988, pp. 2-3.

4. Brown. *Op. Cit.*, p. 14.

5. Defense Industry Initiatives on Business Ethics and Conduct. "Public Accountability," 1987 Annual Report to the Public and the Defense Industry, January 1988, p. 1.

6. The Honorable Robert B. Costello, Under Secretary of Defense (Acquisition), Remarks to Federal Bar Association, Pentagon Chapter, Fort Myer, Va., May 10, 1988, p. 8.

7. Ibid, pp. 8-9.

8. Defense Industry Initiatives. *Op. Cit.*, p. 1.

9. Costello. Remarks to Federal Bar Association, *Op. Cit.*, pp. 9-10; Defense Industry Initiatives. *Op. Cit.*, pp. 1-7.

10. Costello. Remarks to Federal Bar Association, *Op. Cit.*, p. 10.

11. Letter from Deputy Secretary of Defense to defense contractors, July 24, 1986.

12. Letter from Deputy Secretary of Defense to defense contractors, August 10, 1987.

13. Interview with Morris B. Silverstein, Assistant Defense Inspector General, Criminal Investigations, Policy and Oversight, July 28, 1988.

14. Ibid.

15. Statement by The Honorable Frank C. Carlucci, Secretary of Defense, before Senate Armed Services Committee, "Defense Acquisition Systems," July 12, 1988, p. 5.

16. Testimony of The Honorable Frank C. Carlucci, Secretary of Defense, before House Armed Services Committee, "Procurement Fraud," July 26, 1988, p. 2.

17. Ibid, pp. 2-3.

INTERNATIONAL NCO PANEL AT

RMCM James E. Hoffman, USN



An integral part of the 20-week Program Management Course (PMC) taught at the Defense Systems Management College (DSMC), Fort Belvoir, Va., are weekly guest lecturers and speakers. These include a panel of Senior NCOs from the four U.S. military services. In keeping with the DSMC commitment to stay in touch with the user, the Senior Enlisted Panel addresses issues for present and future program managers from a customer's viewpoint. Coordinated by the former DSMC Senior Enlisted Advisor, Senior Chief Larry J. Dyer, USN, a PMC class enjoyed the first Panel with an international flavor. An Army Sergeant Major from the Federal Republic of Germany joined representatives from the U. S. Navy, Army, Air Force and Marine Corps.

The Panel

Members of the Panel were as follows:

—Master Chief James E. Hoffman, current DSMC Senior Enlisted Advisor and Course Director and Lead Instructor for the Program Manager's Briefing Course (PMBC).

—Sergeant Major John M. Hall, Army Atomic Demolition Munitions Specialist and Combat Engineer, now Senior Sergeant Major for the U. S. Army Belvoir Research, Development and Engineering Center (RD&E).

—Master Sergeant Mark A. Smith, C-17 Airlift Missions Systems Manager, Air Force Systems Command, Wright-Patterson AFB, Ohio.

—Master Gunnery Sergeant John J. Anaya, a Development Project Officer in Telecommunications, USMC Development and Education Center, Quantico, Va.

—The international representative, Sergeant Major Klaus-Dieter Scheckel, attached to the German Army Liaison Staff,

U. S. Army Engineer Center, Fort Belvoir. These five represent 101 years of user experience.

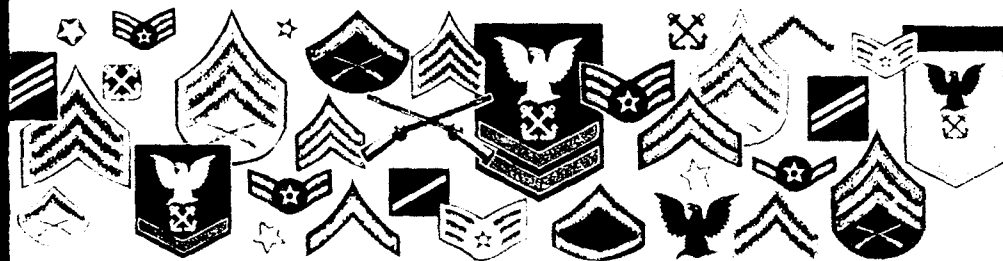
The Message

Master Chief Hoffman stressed the criticality of interoperability among branches of U. S. Armed Forces. Citing experiences while a member of the Communications Department in the *USS Independence* (CV-62) during the 1983 Grenada invasion and Lebanon bombing raids, the Master Chief said, "I'm not giving away any secrets when I tell you that interoperability and communications went together like interservice and cooperation do at budget time." Interservice communications during Grenada were criticized by the media after the operations. Lessons were learned throughout the military services at all levels. Only with aggressive follow-up action will we realize any benefit from those difficult lessons.

Sergeant Major Hall spends much time visiting field units to evaluate Army research development and evaluation. "We need to listen, really listen, to our soldiers," he said. Today's soldiers are better educated, trained and equipped than ever before. Let's stop selling them short and realize their good ideas are worth listening to. Test and evaluation teams are welcome in the field, but when you go to these units to test a new weapons system, dress for the terrain and experience what they experience. Leave your three-piece suit and alligator shoes at home and stay in a foxhole, not a motel room. Eat out of a can and go without sleep for 3 days. Test your product where it will be used—in the Korean DMZ during winter snows, in the searing heat and blinding sandstorms of the desert, and in the oppressive humidity of the jungle. Only then can we be sure new systems will operate as designed and are what men and women in the Armed Forces today deserve—the best equipment possible.

DSMC IS WELL RECEIVED

RMCS Larry J. Dyer, USN



Master Sergeant Smith's position in the Air Force C-17 program office has given him the opportunity to provide continuing input into the aircraft's cargo compartment systems and mission equipment. Having logged more than 3,500 hours in C-141/A/B cargo aircraft and attaining the Air Force highest crew qualification, Flight Examiner Loadmaster, he was selectively assigned to the C-17 system program. A major selling point for development of the C-17 was reducing crew members by two flight engineers and one loadmaster from the normal crew size in most of today's cargo aircraft.

Having an enlisted expert as an active member of the program office since the beginning of the program has helped contractor and program manager immeasurably. A level of expertise in cargo handling procedures that can be gained only through "hands-on" experience was provided at minimal cost to the Air Force, and no cost to the contractor. This resulted in great savings of man-hours and money. Master Sergeant Smith said, "We can help you do your job. We can make it easier on the contractor and the program managers."

Master Gunnery Sergeant John J. Anaya brought almost 30 years of experience in Marine Corps research,

development logistics planning, and acquisition to the panel: 30 years in which two basic problems are yet to be solved—training and equipment manuals. When there are funding cuts, the first area affected seems to be training. Schooling provided today to our operators and technicians appears to be inversely proportional to the sophistication and complexity of our weapons systems. Course lengths have been reduced to save money and operators and technicians are forced to rely heavily upon written manuals. Top Anaya said, "These manuals are often written in Sanskrit, illustrated by stone masons, and poorly organized." A better product can be made available and anything less than the best should be unacceptable.

Sergeant Major Scheckel highlighted recent successes in joint international weapons systems development among NATO countries, namely the Tornado fighter/bomber, Roland and Patriot air defense systems, and a new camouflage pattern. There is room for considerable improvement in the multinational arena, starting with a more equitable flow of technical data and hardware. Closer cooperation can only promote partnership and strengthen the alliance. Additionally, Sergeant Major Scheckel said, "we need to speed up standardization and

interoperability of weapons systems, as well as harmonize operational and logistical requirements." Allies should meet more often in workshops, and acquisition personnel should visit the field to get the soldiers' opinions about equipment provided.

From a user perspective, it would appear our weapons systems acquisition process has become convoluted and cumbersome and borders on being self-defeating. The soldier, sailor, airman and marine struggle with systems that do not perform as designed, and require interminable waiting periods for spare parts. Service people are forced to use poorly written technical manuals and go without proper training. Rules say "do not violate the warranty," and the on-scene commander says, "make it work." Rice bowls are fiercely protected as we spend untold millions on virtually identical, redundant systems. Better is the constant enemy of good enough. Contractors are hamstrung with unrealistic, outdated military standards and specifications. Although many improvements have been made in the U.S. weapons systems acquisition process, particularly in the areas of fraud, waste and abuse, there is room for enhancements in other areas.

Conclusion

The NCO Panel does not presume to have all the answers, but there are some things that every acquisition professional can do to improve the system. First and foremost is to listen, really listen, to people operating, repairing, and maintaining our weapons systems. Make time and find the money to get key people out of the office and into the field or on the ships. Test equipment in the environment in which it will be used—not just the laboratory or proving grounds under optimum conditions.

Remember that more is not always better. One thousand new tanks with fully trained crews and adequate spare parts may be more effective than 3,000 new tanks with partially trained crews and insufficient spare parts. Examine our manning doctrine throughout the military services. A senior enlisted billet shifted from operational forces to a program office could more than pay for itself by providing years of "hands-on" experience in the development of new or improved systems and equipment similar to many items in use.

PRODUCIBILITY PRACTICES

*Robert A. Rathe
David D. Acker*

*Mr. Rathe is a Manager of Advanced Concepts Systems Center,
FMC Corporation.*

*Mr. Acker is a Professor of Engineering Management,
Defense Systems Management College.*

Producibility, the relative ease of producing a product, is governed by characteristics and features of the design that enables economical fabrication, assembly, inspection, testing, and acceptance of a product using production technology available.

A recent report, published by a subcommittee of the Research and Engineering Committee (REC) of the National Security Industrial Association (NSIA), stated there isn't enough emphasis placed on producibility during formative stages of product development.¹ Also stated is that consideration of manufacturing processing is sometimes delayed until the pilot production phase of a defense system program resulting in hardware and software developed that may not be producible.² This would indicate need for design changes. During pilot production, the cost of such changes is relatively high and the results may be suboptimal. This led to the need for an industry group to study producibility practices.

The study results released by NSIA will provide industry and government with information on present-day producibility practices and the effectiveness of these practices in production of defense systems for the Department of Defense (DOD). Implementation of suitable producibility practices has been emphasized by DOD and industry in the past few years. To support this need, the transition from development to production initiative, DOD Directive 4245.7, and

Air Force Systems Command (AFSC) Regulation 550-13, have been issued.^{3,4}

The NSIA subcommittee's key task was to identify, study and resolve, to the extent practical, technical and managerial problems associated with implementation of government policy fostering producibility. Also, the subcommittee was tasked to provide advice to all concerned on how to improve coordination among concerned departments within each contractor's organization, as well as among contractors and subcontractors involved in the design and manufacture of a product, such as a defense system or equipment.

Formation of Subcommittee

In September of 1984, a NSIA Producibility Subcommittee (hereinafter referred to as the subcommittee) was formed with industry participants from the Research and Engineering Committee and the Manufacturing Management Committee. After discussions with John A. Mittino, then Deputy Assistant Secretary of Defense (Production Support), Office of the Secretary of Defense (OSD), he agreed to sponsor this activity. The subcommittee was tasked with studying the impact of the Producibility Engineering and Planning (PEP) and the transition initiatives. Further, the subcommittee was asked to recommend to DOD improvements to appropriate DOD directives and the W.J. Willoughby, Jr., transition from development to production templates.⁵

PRODUC

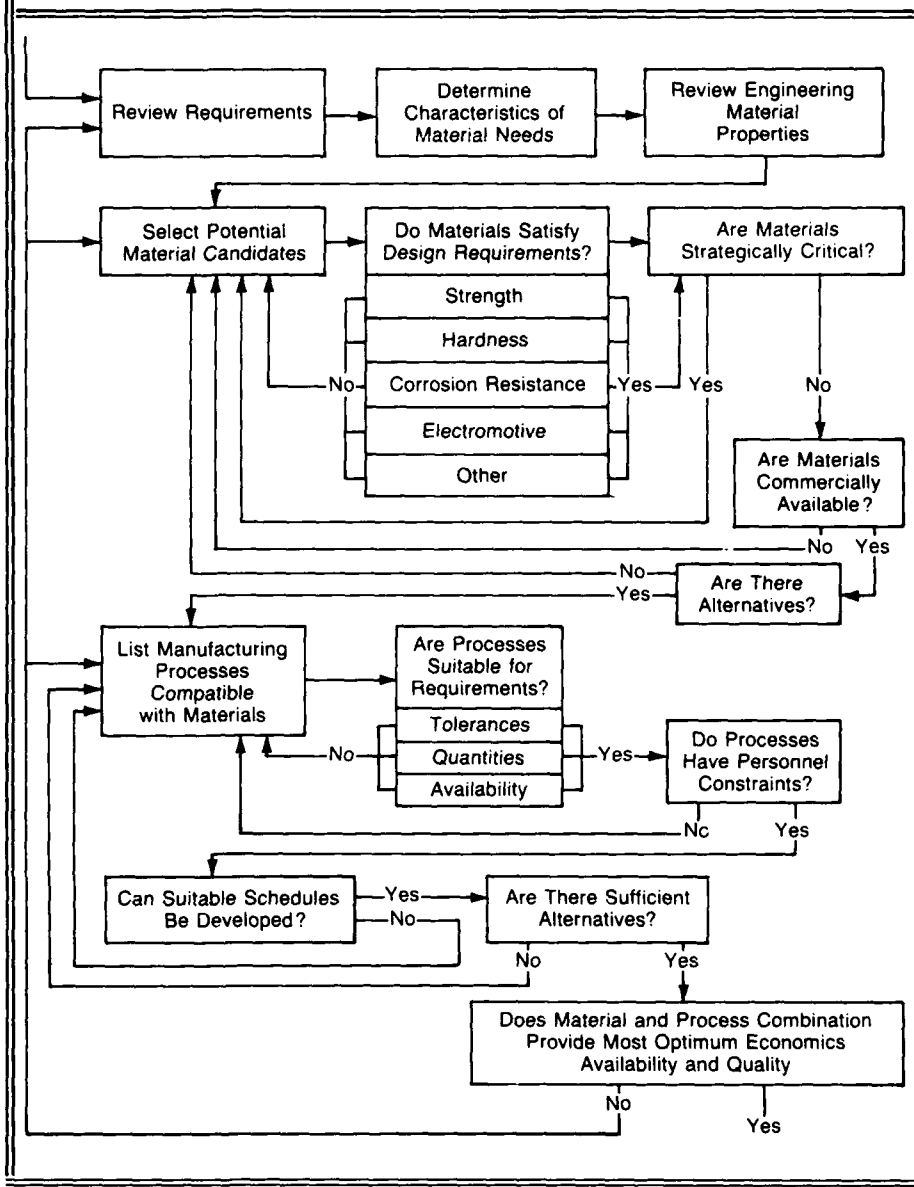
The subcommittee prepared a questionnaire to collect data on which to base its recommendations. At the same time, it reviewed the producibility data base that existed at that time. The questionnaire was sent to NSIA member companies in November 1986, and recommendations in the final report result from responses of 26 member companies who participated in the survey. The company responses and inputs from subcommittee members formed the basis for the recommendations in the final report.

Definition of Producibility

Producibility is a measure of the relative ease of producing a product. The definition of producibility may be derived from the description in Military Standard 1528 and Military Handbook 727.^{6,7} For our purpose, let us define producibility as the composite of characteristics which, when applied to product design and production planning, leads to the most effective and economic means of fabrication, assembly, inspection, test, installation and checkout (when applicable), and acceptance of a product. In other words, producibility is the coordinated effort of design engineering and manufacturing engineering personnel to create a functional design that can be easily and economically manufactured. The most producible design is one that can be made by any group of reasonably skilled workers from appropriate materials in a timely and economic manner without sacrificing function, performance or quality.

The DOD policy addresses the need for producibility consideration early in the design process, because producibility influences the entire design effort from that point on in every phase of the product life cycle. Inherent producibility limitations must be recognized and addressed throughout the

FIGURE 1. PRODUCIBILITY CONSIDERATIONS DURING THE ITERATIVE DESIGN PROCESS

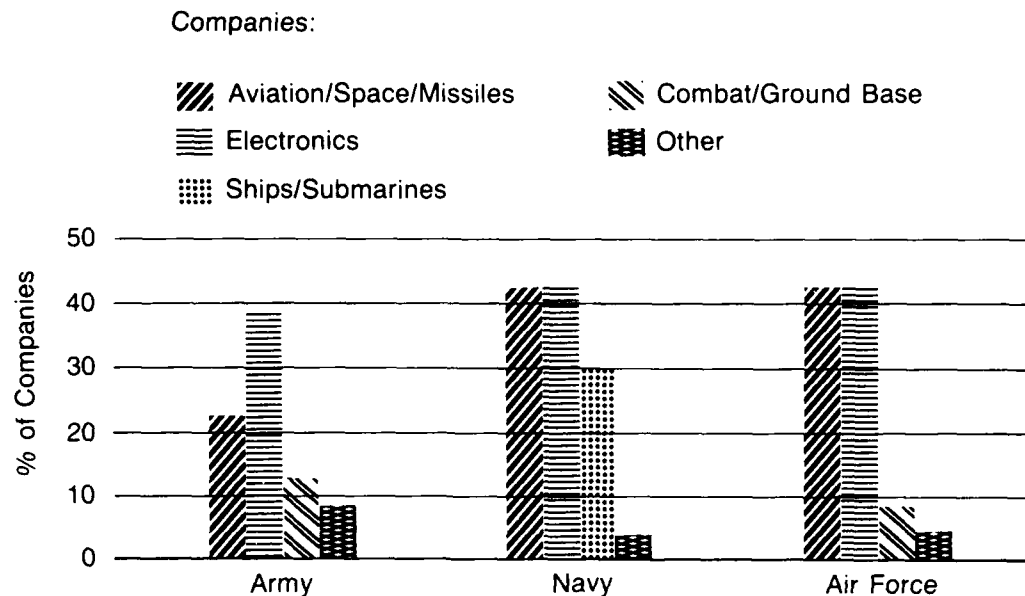


product life cycle. The iterative design process displayed in Figure 1 is filled with decision points, each of which permits a potential trade-off against some other requirement.⁸ Producibili-

ty, reliability, availability, maintainability, and safety are demands upon the product that interact heavily throughout the design process, thereby creating the need for trade-offs.

PRODUCIBILITY

FIGURE 2. DOD CUSTOMERS PARTICIPATING IN SURVEY



The DOD transition initiative relates well to the producibility engineering and planning (PEP) requirements with specific objectives for implementation on contracts. It is well known that poor preparation prior to the full-scale development phase of a program will lead to production problems later on.

Study Approach

The subcommittee prepared a questionnaire and submitted it to NSIA member companies to accumulate data on which to base its recommendations. Twenty-six companies responded. These inputs and others from interviews were reviewed and analyzed by subcommittee task leaders, select study group members, and the chairman. Final recommendations were formulated.

The questionnaire was divided into four parts for distribution to people within each participating organization:

- Company and Contract Management
- Design/Manufacturing Interface
- Manufacturing Technologies and Management
- Quality Assurance.

The questionnaire dealt with producibility practices, the use of manufacturing technology and software tools, and assessment of the impact of the practices on design and manufacture. Companies responding to the survey were divided arbitrarily into five categories for the purpose of combining data into logical groupings: aviation/space/missiles, electronics, ships/submarines, combat/ground base, and other. A particular contractor could fall into one or more categories. See Figure 2.

Industry Producibility Practices

Respondents, when asked how often they incorporate producibility planning into the development process, indicated they did so less than one-third of the time, unless such planning was a contractual requirement (Figure 3). About half of the respondents said that fewer than 25 percent of their contracts require a plan for producibility. More than 20 percent of the companies always assess producibility, and more than 75 percent of the time they develop and execute producibility plans. In companies who always assess producibility, this is carried out dur-

ing pilot production in the concept demonstration/validation phase.

In Figure 4, of the companies who responded, only 50 percent have producibility programs in place. Although only 40 percent have producibility goals and objectives, almost all respondents have quality-assurance policies, more than 90 percent have make-or-buy policies, and about 55 percent have design-to-cost policies. Of companies with producibility goals and objectives, less than 50 percent have methods for measuring producibility. About half of the respondents indicated their company requires manufacturing sign-off on hardware data packages during the concept demonstration/validation phase, or later. Only one company required sign-off in the concept exploration phase.

Manufacturing has the most influence on design before Critical Design Review (CDR) and design freeze, and it has the least influence during the concept exploration phase and after the design freeze. Yet, the predominant period for producibility consideration is during pilot production.

FIGURE 3. PRODUCIBILITY PLANNING AS PART OF DEVELOPMENT PROCESS

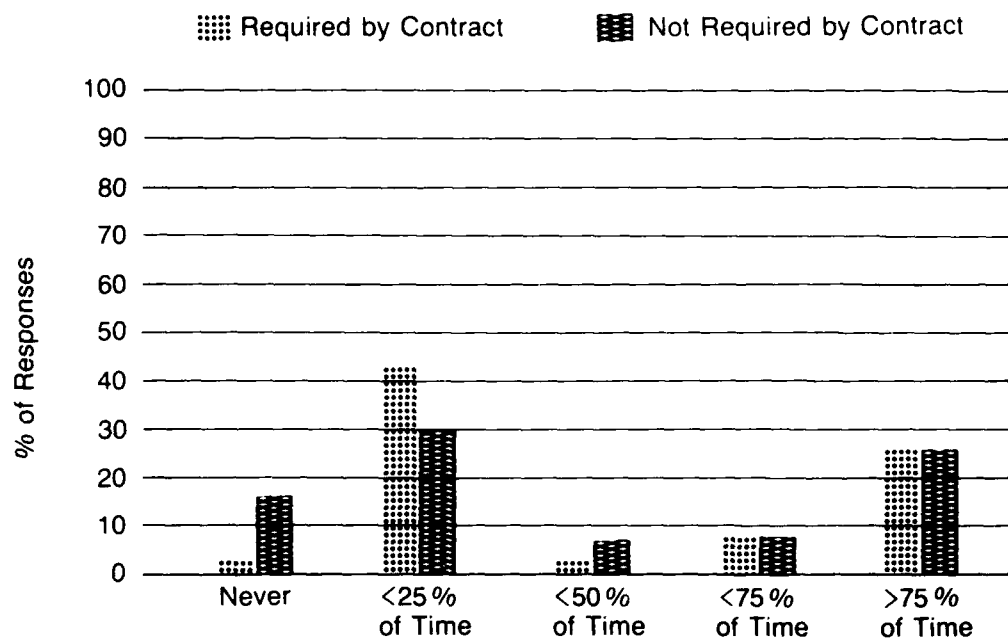


FIGURE 4. COMPANIES WITH IMPLEMENTED PRODUCIBILITY POLICIES

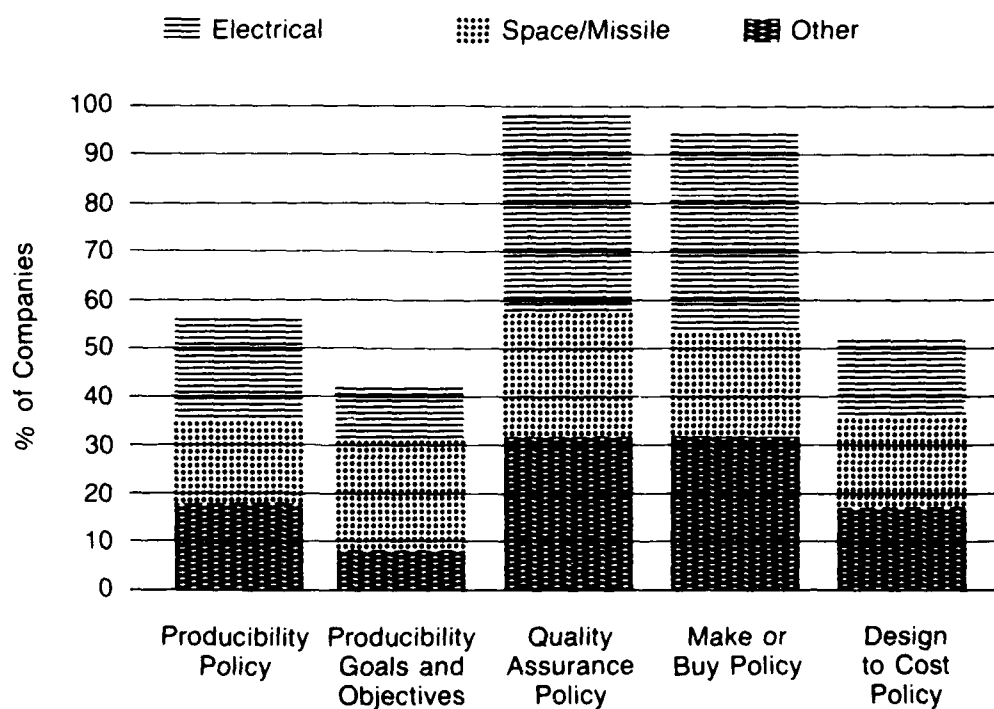
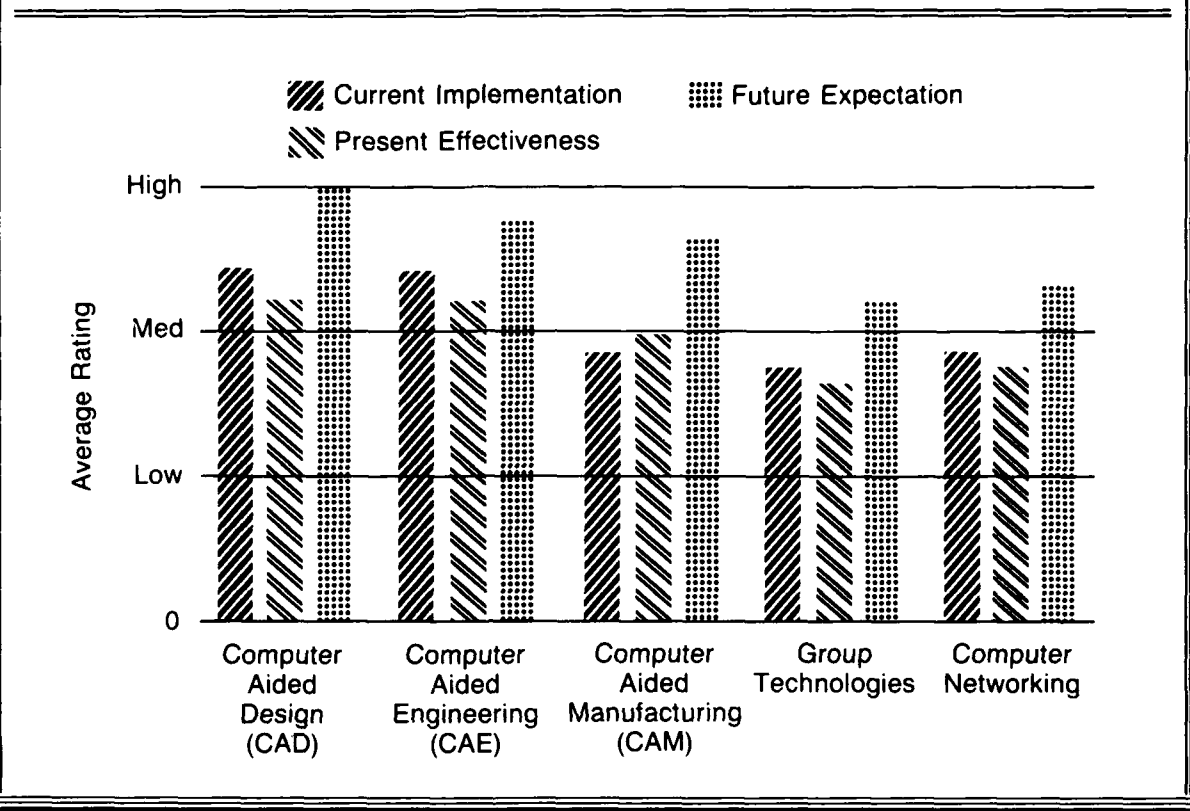


FIGURE 5. EFFECTIVENESS OF INTERFACE TECHNOLOGIES ON DESIGN AND MANUFACTURING



Government Incentives

Government actions to encourage consideration of producibility on defense systems programs include:

- Elevate the status of producibility to the level of that given to reliability, availability, and maintainability.
- Emphasize producibility in the source selection process.
- Provide financial incentives that are based on results.
- Fence funding for process planning and producibility during the manufacturing period.
- Recommend use of the Willoughby templates and similar practices.

—Emphasize producibility at the Preliminary Design Review (PDR), the Critical Design Review, and integrated logistics support meetings.

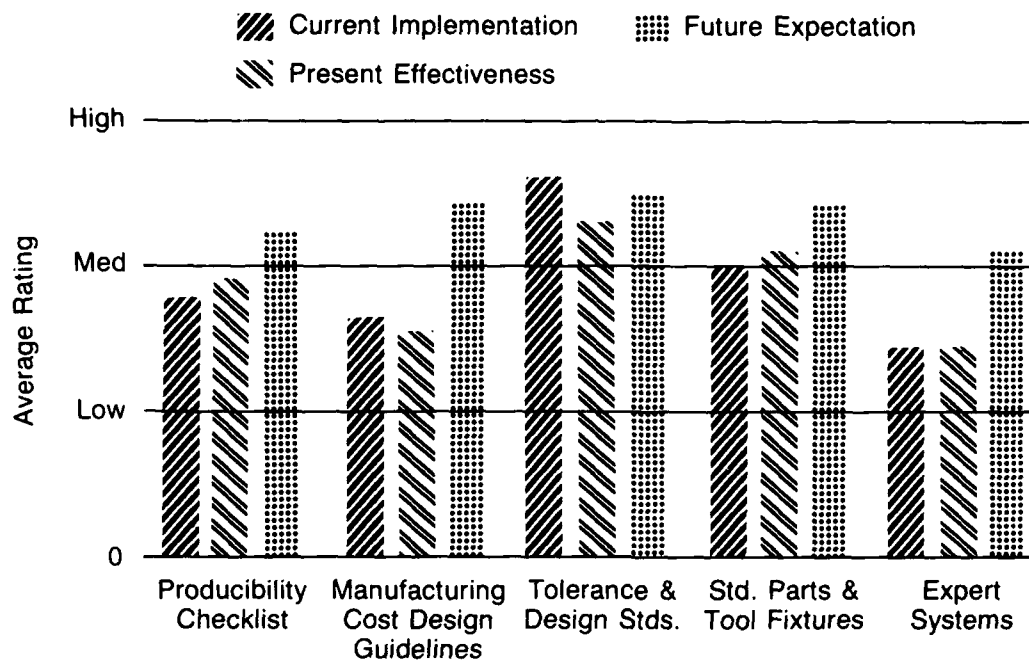
—Encourage participation by experienced manufacturing personnel in reviews.

At contractor and subcontractor levels on a defense system program, there should be a producibility engineering plan with well-defined milestones, adequate funding, incentives to make things happen, and appropriate training. Further, design engineers and manufacturing personnel should communicate and cooperate effectively to ensure the program success.

Critical Interfaces

In the majority of companies who participated in the subcommittee survey, there is a lack of mutual appreciation by engineering and manufacturing personnel. In many companies, engineering design details are 'tossed over the wall' and manufacturing personnel are expected to produce the parts and assemblies from the drawings and associated documents, and computer printouts with little or no interface with the designers. Thus, it appears a chasm exists between the design and manufacturing engineers. As a result, in many companies the design and manufacturing engineers lack understanding of each other's problems or goals.

FIGURE 6. EFFECTIVENESS OF INTERFACE TECHNOLOGIES ON DESIGN AND MANUFACTURING



Expectations are usually high in industry relative to the value of technology tools to improve producibility. Computer-aided engineering (CAE), computer-aided design (CAD), computer-aided manufacturing (CAM), computer networking, and other data base systems are used most now and are expected to have an important role in the future. An important adjunct to these systems is the use of computer networking and shared data bases to transfer information between engineering and manufacturing departments within a company and between the contractor and the government customer.

The design/manufacturing interface hardware and software tools are effective

in improving communications. The effectiveness of the tools and level of implementation is shown in Figure 5. Most of them are available or will be available soon. Industry expects to benefit from these tools.

Other tools impacting producibility are producibility checklists, manufacturing cost design guidelines, tolerance and design standards, standard parts and tool fixtures, and automatic design systems/expert systems. This group of interface technologies is not considered as effective as those described in preceding discussions but the group is having a moderate impact on producibility. The effectiveness ratings of these interface technologies are shown in Figure 6.

In the above group, producibility checklists, and manufacturing cost design guidelines were considered most critical for improving communications. Use of these tools should be encouraged during the source selection process and throughout the life of the contract.

To answer the question about how capital should be invested to improve producibility, the following received the most votes:

- CAE/CAD/CAM
- Manufacturing cost design guidelines
- Computer networking
- Statistical process control
- Training courses.

FIGURE 7. EFFECTIVENESS OF AUTOMATION ON PRODUCIBILITY

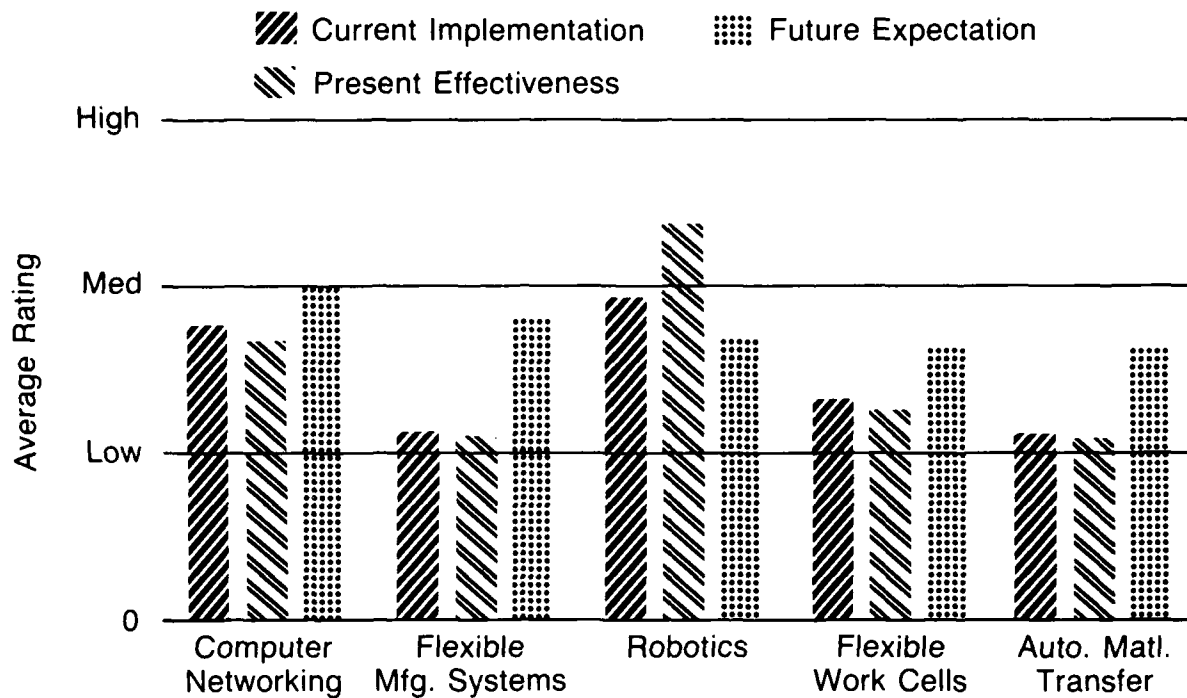


FIGURE 8. EFFECTIVENESS OF AUTOMATION ON PRODUCIBILITY

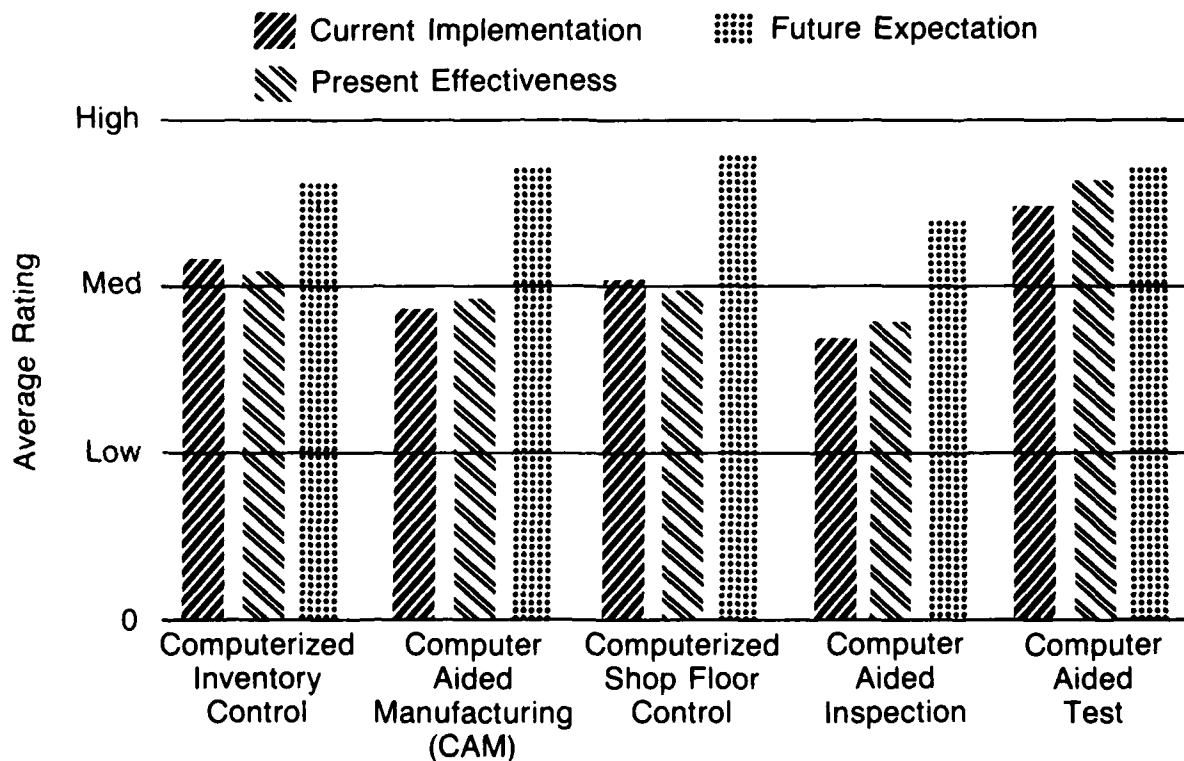
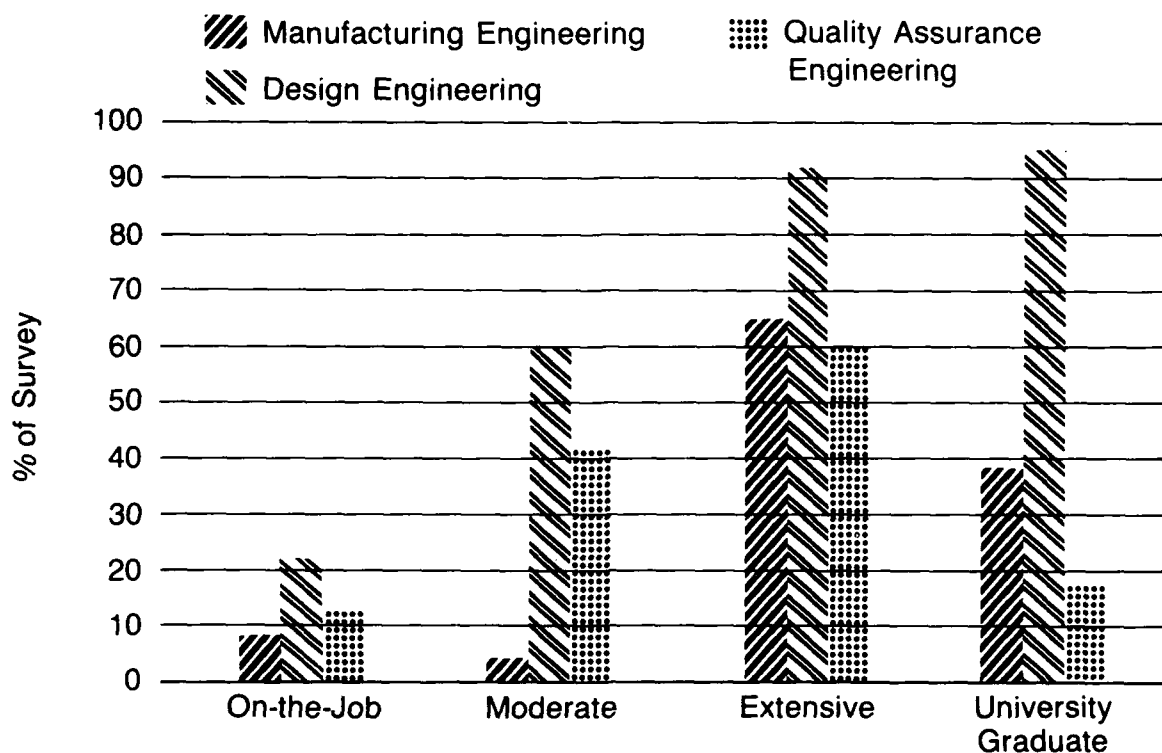


FIGURE 9. TRAINING REQUIRED



Technology Impacting Quality

Manufacturing technology and software tools that impact quality and improve process control include:

- Computer networking to share information and data
- Computerized inventory control to improve production control
- Robotics to reduce cost and improve repeatability
- Flexibility manufacturing work cells.
- Computerized shop floor control to automate the processes and eliminate errors
- Computer-aided manufacturing, inspection and test to improve quality and assist in building quality in and avoid costly rework.

Automation is not considered the key to a more producible design. Therefore, it was not rated high by industry and future expectations were not high. The effectiveness of automation, as viewed by the participants, is illustrated in Figure 7. Quality and cost are impacted by manufacturing automation.

Factory automation techniques using computerized inventory control, manufacturing, shop floor control, inspection, and test are regarded favorably. Their effectiveness is shown in Figure 8. This finding was especially valid in electronics and aviation/space/missiles manufacture.

Highly efficient and controllable processes reduce cost. Highly repeatable processes improve quality control, and reduce scrap. New and unique materials and processes must be qualified before a production decision is made. Capital intensive equipment with software driven controls can improve quality and efficiency. Factory automation does not improve producibility unless the design is tailored to the capabilities. Efficient manufacturing is encouraged when incentives are tied to unit production costs.

Role of Training in Improving Producibility

Producibility training is necessary for design, manufacturing, and quality assurance engineers and can help eliminate the chasm which often exists

between these engineers. The importance of training is illustrated in Figure 9. Extensive on-the-job training and job rotation are effective. However, formal courses by the government and universities are needed. Experience may replace the need for formal education of manufacturing and quality assurance engineers. Formal courses emphasizing manufacturing cost and the producibility aspects of design are needed.

Survey Results

Survey responses supported producibility planning as a logical and necessary part of profitability. Respondees expressed the lack of support and incentives, lack of funding and poor communication as primary roadblocks to implementation. It is difficult to achieve and evaluate performance that cannot be measured, and industry has not established standard performance measurements for producibility.

Lack of communication and understanding between design and manufacturing engineers represents a chasm that has existed for years. Solutions are

being explored and the gap is being slowly bridged. Collocation and interaction, common goals, and improved education will promote good communication. Manufacturing concerns must have equal weight with design concerns before common goals are accepted and achieved.

Factory automation and new technology tools can improve producibility, if they are considered in the design and review process.

Training in producibility techniques and cross-training of design and manufacturing personnel can build awareness, improve communication and expand capabilities. Consideration should be given also to collocation of design, manufacturing, and quality control people on a defense system program to improve communication as well as coordination.

Recommendations for Government

As a result of the survey, the subcommittee recommends that the government institute the following practices:

- Elevate producibility to status of reliability, availability and maintainability during design reviews and the test and evaluation phases.

- Give the producibility program increased importance in source selection process.

- Include a producibility contract data requirement list (CDRL) in hardware development contracts.

- Provide fenced funding for manufacturing for process planning and producibility programs.

- Require the participation of experienced manufacturing personnel in reviews.

- Make manufacturing concerns equal to design concerns in the review process.

- Make standardized producibility performance measurement part of the contract performance requirement.

- Encourage efficient manufacturing operations and producibility considerations through incentives tied to unit production cost.

- Support producibility by rewarding results.

- Encourage use of the Willoughby templates, or similar practices.

- Fund studies to develop effective producibility measurement techniques.

Recommendations for Industry

The subcommittee recommends that the industry adopt the following practices:

- Set specific producibility goals and objectives for each program.

- Incorporate specialized manufacturing knowledge early in the design process.

- Encourage cultural changes to eliminate the chasm existing between design and manufacturing engineers.

- Make communication easier between design and manufacturing engineers through collocation and interaction, common goals and improved education and training.

- Use computer networking and shared data bases to improve communications and disseminate knowledge throughout each defense system program.

- Establish producibility milestones and goals on each defense system program, as well as methods of measurement.

- Reward accomplishment of specific producibility goals on each defense system program.

- Consider factory automation capabilities throughout the design process.

- Use standardized, repeatable manufacturing processes.

- Qualify new or unique materials and processes before making the production decisions.

- Use producibility checklists and manufacturing cost design guidelines.

- Use templates to make the transition from development to production easier.

- Institute extensive on-the-job training in producibility.

- Use job rotation to develop an understanding of producibility and to

expand the knowledge of personnel involved.

- Encourage development of specialized producibility training programs in universities and the Department of Defense.

Recommendations for Further Study

The subcommittee recommends consideration of the following subjects for further study because they have either been briefly reviewed or completely ignored to date:

- Manufacturing process development

- Second-source contracting

- Subcontracting/vendor qualification

- Development of producibility measurement standards

- Knowledge base engineering/artificial intelligence as it relates to process selection

- Establishment of links between computer networks

- Development of producibility courses.

Study in these areas can enhance the totality of producibility.

Conclusion

The subcommittee believes the challenges have been categorized. With this knowledge in hand, improvements become the responsibility of DOD and industry teams working together on the production of future defense systems and equipment. Hopefully, DOD and industry will profit from consideration of, and action on, the information available today.

Endnotes

1. Members of the Producibility Subcommittee of the National Security Industrial Association (NSIA) Research and Engineering Committee: Robert Rathe, FMC Corporation, Chairman; John Fedorochko, Raytheon; Howard Weinstein, Westinghouse; Mark Trout, Magnavox; John Marinshaw, FMC Ordnance; Dennis Feld, Good-year Aerospace; William Widing, Jr., Harbridge House; Tom Hillstrom, FMC Northern Ordnance.

2. Producibility Study Report, "A Status Report on Industry Practices and Their Effectiveness in Providing DOD Procucible Systems," prepared by the NSIA Systems Engineering Subcommittee of the Research and Engineering Committee, September 1988.
3. Department of Defense Directive 4245.7, "Transistion from Development to Production," January 19, 1984.

4. Air Force Systems Command Regulation 550-13, "Commander's Policies on Requirements Process," March 18, 1988.
5. Department of Defense Manual 4245.7-M, "Transition from Development to Production," September 1985.
6. Military Standard 1528, Revision A, "Manufacturing Management Program," September 9, 1986.

7. Military Handbook 727, "Design Guidance of Producibility," April 5, 1984.
8. The figure displaying producibility considerations during the iterative design process is reproduced from Figure 8 in *Department of Defense Manufacturing Management Handbook* for Program Managers, Second Edition, July 1, 1984, published by the Defense Systems Management College.

INSIDE DSMC



Clark



Millikin



Roberts



McGovern



Hornick

Rolf H. Clark is a Professor of systems acquisition, Department of Research and Information. From 1980-87, he was a Professor at The George Washington University. Dr. Clark, a retired naval officer, received a B.S. degree from Yale University, an M.S. degree from the Naval Postgraduate School, and a Ph.D. degree from the University of Massachusetts.

Lieutenant Colonel Bert A. Millikin, U.S. Army, is a Professor of systems acquisition, Business Management Department. He has been Commandant of Cadets at John Carroll University (1979-81), and a Graduate Pro-

fessor of economics at the Florida Institute of Technology (1983-87). Lieutenant Colonel Millikin holds a B.A. degree in economics from Ohio State University, and an M.S. degree in contracting from Florida Institute of Technology.

Alan J. Roberts is a Professor of acquisition management, Technical Management Department. He came to DSMC from the Mitre Corporation where he was a senior vice president on the corporate staff. Mr. Roberts holds B.S. and M.S. degrees in electrical engineering, both from the Massachusetts Institute of Technology.

John P. McGovern is a Professor in the Technical Management Department. Before joining DSMC in April 1988, he was associated with the IBM Corporation. Mr. McGovern holds a B.S. degree from West Virginia University and an M.S. degree from the Rensselaer Polytechnic Institute.

Phillip J. Hornick is a Professor of engineering management, Program Manager's Support System Directorate. He came to DSMC from the Naval Sea Systems Command. Mr. Hornick holds a B.S.E.E. degree from California State University, Fresno, and an M.S.E.E. degree from the University of California, Santa Barbara.

Losses

Al Bottoms, Navy Chair, transferred.

Cindy Cano, Center for Acquisition Management Policy, to private industry.

Troy Caver, Technical Management Department, resigned.

Captain George K. Coyne, Jr., USN, Dean, Department of Research and Information, retired.

SCPO L. J. Dyer, retired.

Major James C. Harris, USAF, retired.

Fred Hughes, Graphic Arts and Photography Division, retired.

John Nieroski, Research Directorate, reassigned to Navy Data Automation Command, Washington Navy Yard.

Blanche Shiflett, Information Directorate, retired.

Gains

Roy E. Cornwell, Supervisory Supply Technician, Supply Directorate.

LIVE FIRE TESTING: PLANNING IMPLICATIONS FOR ACQUISITION PROCESS

Colonel Larry R. Stanford, USA

The FY 1987 Defense Authorization Act amended Chapter 139 of Title 10, United States Code, by adding requirements for vulnerability and lethality live fire testing (LFT). Implementation of live fire testing will necessitate the establishment of a vulnerability or lethality evaluation planning process at the initiation of major weapon systems and munitions development programs. It is critical that a live fire test and evaluation (LFT&E) strategy then be described to define the testing required. Objectives of this article are to:

- Describe an LFT&E process that DOD and military service testers and evaluators may follow to comply with LFT policies and procedures

- Provide a structured body of information for preparation of the LFT portion of the test and evaluation master plan (TEMP).

Testers and evaluators should be aware of three salient features of the LFT program: (1) The Congress mandated implementation of this program in the FY 1987 Defense Authorization Act, which was further amended by the FY 1988-1989 Defense Authorization Act; (2) the military services will fund and conduct tests and evaluations of their respective systems; (3) the Office of the Secretary of Defense (OSD) has oversight of the LFT program in that the LFT&E strategy for a system must now be described, in detail, in the LFT portion of the test and evaluation master plan for which the LFT office of OSD has approval authority. Additionally, the LFT office will review and comment on the Services' detailed live fire test and evaluation plans.

The essence of live fire test and evaluation is the assessment of vulnerability or lethality of a system in realistic conditions. Live fire testing must be based on a firm empirical foundation, effectively planned, designed, conducted, reported, and evaluated. If the foregoing statement can be considered valid for all test and evaluation, why is it so important to be restated when addressing live fire testing? The answer is simple. LFT is unique! What makes it unique?

The essence of live fire test and evaluation is the assessment of vulnerability or lethality of a system in realistic conditions.

For purposes of this article, the answer rests with the situation of trying to use traditional developmental testing (DT) procedures (data event) to evaluate larger, overarching vulnerability and lethality issues. Specifically, the old, lock-step, technical test procedures are inadequate. What is needed is an evaluation process (not a test event) to develop and overlay an LFT strategy on the acquisition strategy.

The nine steps of the LFT&E process are a simplification to introduce the concept of planning for live fire testing within the TEMP and program objective memorandum (POM) processes, and the conduct of the live fire test and associated evaluation. The actions in the process will vary slightly depending on the system addressed and Service differences. Despite these differences, this process has a minimum number of essential steps which follow:

- Understand weapon system
- Perform vulnerability or lethality analysis
- Develop critical LFT issues
- Describe measures of evaluation
- Define LFT objectives
- Derive data requirements
- Describe evaluation or analysis procedures
- Determine LFT resources and constraints
- Prepare LFT strategy.

The *first step* in initial planning for a live fire test and evaluation is to study the weapon system. The study effort should center on establishing the vulnerability or lethality requirements of the system, understanding the operational environment and the relationship of the system to that setting, and determining current and future (initial operating capability) threat projections, including specific items of threat equipment and the doctrine and tactics governing employment of that equipment.

The *second step* in the LFT&E process is to perform vulnerability or lethality analysis, depending on the particular system under consideration. This step might be accomplished through an exercise of computer models. Another way is to use personnel who have expertise in the vulnerability or lethality arena to perform analysis "by hand." Either method should provide a documented identification of areas of concern and, equally important, of data voids that could limit the reliability of the analysis. Areas of concern are items that increase the vulnerability of the system or decrease its lethality which can be modified as appropriate to produce a better system. Data voids are addressed during test planning, together with unresolved areas of concern.

The *third step* in the process calls for identifying and developing critical issues for the evaluation of the system: basically the goals. An LFT issue is any aspect of a system's capability that must be questioned when assessing the system's vulnerability or lethality. This is normally done by stating the vulnerability or lethality capability, converting the capability to an issue, stating the issue, and reviewing for completeness. An issue should be simple enough to preclude ambiguity, but complete enough to cover all a decision-maker would need to know regarding vulnerability or lethality. Good issues stand alone, are phrased in the form of a question, are limited to the fewest possible, are expressed in the context of measures, exclude data requirements, and exclude test conditions. An example of an LFT issue might be "What is the lethality of the

XYZ system against appropriate targets configured for combat?"

The *fourth step* in the LFT&E process is to develop measures of evaluation. These measures are normally defined as expressions of the level of performance the weapon system or munition must demonstrate in the area of vulnerability or lethality during the various live fire tests. Each LFT&E issue normally requires at least one measure of evaluation; some issues may require more than one. The number of measures must be the minimum essential to provide decision bodies adequate information from which to gauge the vulnerability or lethality of the tested system. The purpose of the measures of evaluation is to provide a basis for analysis of the actual versus predicted or expected vulnerability or lethality of a system. This information will be used in comparison with historical data, cost effectiveness analyses, trade-off analyses, the threat, and other analyses of requirements to determine how, when, and whether design deficiencies demonstrated by live fire testing will be corrected as the system proceeds further in the development cycle.

After the measures of evaluation are developed, the *fifth step* in the process is to define the testing objectives. Perhaps one of the most common sources of error has been the apparent confusion of authors on the difference between testing and evaluation. Many times a test will have as its purpose, or in its objectives, "to evaluate...." Remember: A test "collects information to assess..." or similar wording. Test objectives are the operational definition(s) of the purpose of any particular test and describe what will be done on the test site to satisfy the LFT issues. Test objectives should be as condensed as possible but not unnecessarily segregated into small areas of investigation. An example of a test objective might read "to collect data on the effectiveness of the XYZ system in killing targets."

Colonel Stanford is assigned to the Office of the Assistant Deputy Director, Defense Research and Engineering (Live Fire Testing).

An issue should be simple enough to preclude ambiguity, but complete enough to cover all a decision-maker would need to know regarding vulnerability or lethality.

Derivation of data requirements is the *sixth step* in the LFT&E process.

Ultimately, these data requirements specify the measures required to address the LFT issues. Data requirements are derived through a dendritic thought process that divides test objectives into subobjectives, and subobjectives into progressively finer subdivisions until directly measurable data requirements emerge. Ordinarily, this results in a large, complex, root-like structure. It is usually most convenient to do this in the form of a blackboard exercise because numerous changes are expected during the initial breakdown process. Conducting this exercise is usually the most demanding task of the LFT&E process. When the final derivation of data requirements is complete, the action officer selects data requirements necessary for test. Often, one aspect of vulnerability or lethality has several possible data sources and not all are needed. Some redundancy is desirable, especially when one data element can only be gathered by sophisticated instrumentation subject to failure but can be backed up only by a simpler manual measure. There is, too, ordinarily duplication of data elements in very different aspects of system vulnerabil-

ty or lethality, which may be desirable. Taking both the advantages and disadvantages of redundancy and duplication into account, it is now necessary to decide which data requirements to employ in the test. As stated, the selection of data requirements is an especially demanding task. It also involves some risk of selecting inferior data elements. Therefore, it is advisable to seek the aid of specialists during this task.

After the data requirements have been derived, *the next, and seventh, step* in the LFT&E process is to define the evaluation or analysis procedures to be used. The purpose of this part of the process is to show just how the data from live fire tests and other sources will be applied to answer the LFT issues. The evaluation and analysis procedures are based on an estimation of expected and unexpected resulting data. At this time, specify any assumptions made regarding the composition and availability of the expected data. Further, indicate how each of the areas requiring evaluation or analysis will be developed into findings specifically answering each stated measure of evaluation. In consonance with the amount and quality of data expected and the type of evaluation or analysis planned, a variety of statistical methods are available. For measures yielding data that are not conducive to statistical analysis, various non-statistical numerical techniques may be used. Finally, measures not subject to statistical or numerical analysis may be gathered and reported subjectively. This may include statements of judgment, opinions, observations, and reasons for problems relating to the system being tested. The key here is to understand *a priori*, that the logic behind the development of the evaluation and analysis procedures is essentially a matter of planning how best to report data values obtained for the measures of evaluation.

The previous seven steps of the LFT&E process now form the basis for *the eighth step*: determining the resources required to test and evaluate a system identified for live fire testing and the associated constraints. The product of this step of the process is

a detailed estimate of resources required for the live fire test and evaluation far enough in advance to permit allocation of the program's resources in relation to other testing and non-testing missions. In fact, the LFT&E process being described is based on the known difficulty of accurately predicting and planning for required resources in advance and attempts to provide a form of an orderly procedure for continual updating of requirements. Additionally, resources can constrain the amount of data that can be collected and made available for subsequent use in assessing system vulnerability or lethality. It is essential that all personnel involved with live fire test and evaluation recognize these constraints during LFT strategy planning. The resources and constraints are:

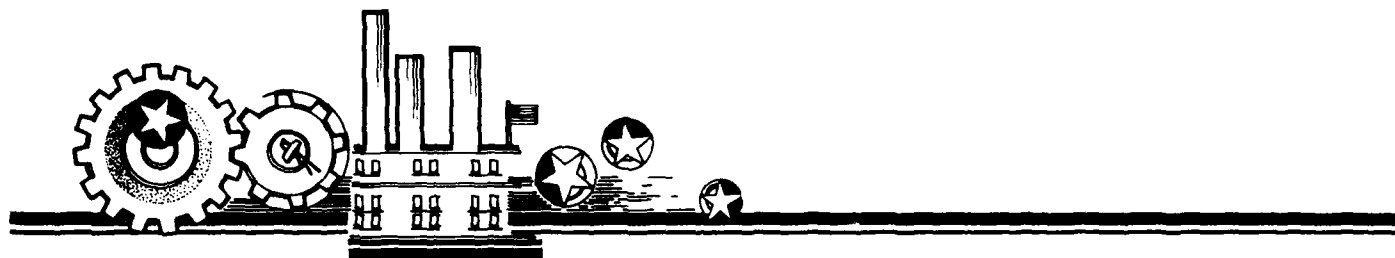
- Money
- Facilities and instrumentation
- Threat targets and munitions
- Schedule or time
- People
- Test items
- Priority.

The *ninth* step in the LFT&E process is to develop the LFT strategy for inclusion in the test and evaluation master plan for review and approval by the LFT office. This means that we have now come full circle to the salient features of this program. It is here and now that trade-off and risk analysis are performed, weighing leverages versus burdens to arrive at a valid, relevant, and realistic LFT program. Factors now to be developed include, but are not necessarily limited to, data sources for satisfying the LFT issues. In this process, it may be convenient to list issues down the side of a matrix and data sources across the top, thereby considering all possible data sources for each issue. Also to be addressed are the long-lead test items, components, and instrumentation needed and the amount and type of live fire testing required to support various milestone decisions. Next, address the need for full-scale, full-up testing versus subscale or component testing, or

other possible alternatives for assessing system or program vulnerability or lethality requiring certification to the Congress by the Secretary of Defense. Next, address the role of threat surrogates. This process will also indicate the critical test resources required for live fire testing and for inclusion in the test and evaluation master plan, will allow the overlay of the LFT strategy on the acquisition strategy to ensure the required testing is completed before the full-scale production decision, and will describe POM implications that can be addressed before the impact becomes critical.

A glance back at the nine steps of the LFT&E process will reveal all the specific critical LFT items to be included in the test and evaluation master plan have been addressed. The process also attempts to resolve three issues that are relevant to live fire testing: adequacy, quality and credibility. Adequacy here refers to a test and evaluation's completeness in addressing system vulnerability or lethality. If a test and evaluation failed to provide first order insights into system vulnerability or lethality, it was a failure in that an amount of uncertainty associated with the system was not identified and reduced or corrected through proper planning, testing, and evaluation. Quality is associated with the relevance of the issues addressed in test and evaluation. Right answers to the wrong questions must be avoided. Live fire tests and evaluations must provide information that is clear and accurate beyond a reasonable doubt. Credibility refers to the degree to which a system's true vulnerability or lethality is examined and assessed. Proper test planning and conduct and aggressive follow-on evaluation are critical in supporting credibility. Test and evaluation conduct must be free from bias, external influence, and personal self-interest beyond any doubt.

Live fire testing and evaluation is here. It is costly and has high visibility. It, therefore, makes good sense to address the LFT issues through a well-planned, well-managed, and well-executed test and evaluation program.



GOVERNMENT/INDUSTRY: TEAMING FOR SUCCESS

Virginia A. Lentz

There was a consistent message from speakers at the fifth annual Defense Systems Management College (DSMC) Alumni Association Symposium May 17-18-19 at Fort Belvoir. The message was "communicate." The theme was "Government/Industry Relationships: Teaming for Success." Communications and quality (improving the processes and real experience) were addressed.

The DOD-Industry-Congressional team needs to communicate. There needs to be more than funding requests from DOD to the Congress. The DOD-Industry team needs to ensure that the Congress hears good news as well as funding requests and sales presentations.

Communicating more openly by the DOD and industry can improve relationships and, perhaps, work processes. The smallest job today is complex with many people required to support a project; poor communications can cause a disaster faster than a 50 percent budget cut.

Speakers

Keynote speaker was the DOD Counsel General, The Honorable Kathleen Buck. The other speakers are listed below.

—Brigadier General William S. Chen, USA, Assistant Deputy for Systems Management, Office of the Assistant Secretary of the Army (RD&A).

—Major General Ray M. Franklin, USMC, Deputy Chief of Staff (RD&S).

—Jim Frownfelter, Bell Helicopter.

—Dr. William Hunter, William N. Hunter Associates.

—Colonel M. Pixton, USMC, PMA276.

—Major General Frank Ragano, USA (Ret.), Chairman of the Board, BEI, Inc.

—Major General Patrick M. Roddy, USA (Ret.), Deputy for Patriot, Raytheon Company.

—Jack Strickland, Production Support, ASD P&L.

Workshop leaders included Dr. Al Beck, DSMC; Hugh Burgay, DSMC; Lieutenant Colonel Ron Higuera, DSMC; William Horner, USA RD&E Center; Ms. Pat Kelley, Cypress International; Gail Kristensen, DSMC; Ms. Susan O'Neal, OSD (P&L); Bob Trimble, Martin Marietta, for the Procurement Round Table; Ms. Elizabeth Warne; and Brian Willoughby, Evaluation Research Corp.

Words from previous seminars were heard: "acquisition streamlining, competition, integrity, defense industry stability, program leadership stability...."

Sustainability

One thing not addressed by speakers was that sustainability is a component of the measure of a successful program. As a graduate of PMC 85-2, I know a successful program balances performance, cost, schedule and sustainability. From the commercial perspective, the counterpart is the preference for evaluating the chief executive officer 5 years after retirement. Since speakers did not include sustainability, can we presume it is not a key component?

The DOD-Industry team is taking steps to keep sustainability in the equation and improve the acquisition process. The Marines have reinstituted the Marine Corps Development Command at Quantico for strategic planning. The Army has reorganized along focus areas. The DOD and Industry are working to implement a computer aided acquisition and logistics support (CALS) system to facilitate program and technical management life-cycle support processes for new and ongoing programs.

The Marines strategic planning organization develops requirements and passes them to the Marine Corps Research Development and Acquisition Command in Washington, D.C., for satisfaction of requirements. The MCRD&AC handles the program objectives memorandum and budget matters. The approach focuses on non-development items (Army). Whenever possible, the Marines will publish their requirements and wait until something comes close, test it, award a production contract, and then upgrade via modifications. They are willing to use a product improvement proposal for the "ilities" if something is ready for the field.

The Marines are developing a professional core of acquisition Marines; duration of a program assignment will be aligned with the program life cycle from research through initial operational capability. The report card will be performance, schedule and cost. Sustainability will occur naturally since fleet duty assignments for the acquisition core will focus on support roles. Fixing a problem helps one understand how to build a better product the next time. This group focuses on improving support to the individual Marine, thereby shortening internal response time.

The Army is improving the process by reorganizing program managers according to major articles under program element offices (PEOs). Initial results indicate this reorganization is effective. The research development and acquisition staff is better informed; thus, the Army acquisition executive is better informed. Program managers receive more management attention and have more time to manage programs; PEOs manage time-consuming, high-visibility issues. The team works more closely with the operations force.

Practical Mechanisms

The CALS and Logistics 2010, two efforts sponsored by DOD, should provide practical mechanisms for improving acquisition management. The CALS is truly a joint program with industry. Defense industry partners with business in the commercial sector are adopting CALS on both sides of the

business; thus, other commercial endeavors benefit from CALS objectives, standards and products.

The CALS strategy has four components.

—Standards for data exchange and integration of heterogeneous data bases.

—Technology that permits development of information models to describe a system: the product definition exchange standard (PDES) describing design and manufacturing data, and the integrated support data base containing the support model. These form a logically integrated weapons system data base to support a weapons system throughout the life of each end-item.

—Contracts and incentives for adoption of CALS by industry and government teams. Programs that move into full-scale development after September 1988 will require CALS compliance.

—The DOD infrastructure and architecture will be modernized to access, accept and use data available via CALS.

An Implementation Guide for CALS, in draft form, should be available in December 1988.

The ongoing effect of changes in the acquisition process was discussed by a Procurement Round Table representative, and in a workshop on competition advocacy.

A discussion of the Management Analysis Center (MAC) Report, funded by several defense industry associations and titled "The Cumulative Impact of Acquisition Policy and Tax Law Changes on the Defense Industrial Base," was well received. The MAC Report recommends that the Congress and DOD restore an appropriate risk/return relationship to the partnership; the aerospace industry contributes the most to balancing the trade deficits today.

One perceived wedge in the DOD/Industry partnership is competition advocacy; government studies present good results. Questions concerned whether studies have looked at all aspects of competition advocacy.

Industry, in general, perceives the current implementation of competition practices to have several shortfalls.

—There is no accounting for the cost of competition. Suggestions for study include bids and proposals, life-cycle cost, and cost of maintaining a technology base at the level to which we are accustomed.

—With the current structure, we are realizing technology leveling; investment by industry may decrease if technology transfer continues to be required for engineering change proposals.

Since DOD solicitations are 60 percent competitive, workshop attendees urged the government to consider shifting focus from pure numbers to improving the competition process, so that the result could be a quality product at the best value.

Next Symposium Planned

"Real Experience" was the topic of speakers associated with successful programs, government and industry. Speakers focused on the need for communications among peer levels of the partnership. They recognized the synergy resulting when each understands the other's business needs, and that sharing risk on innovative solutions results in more innovative solutions. Speakers stressed that front-end economics ignoring life-cycle realities are not cost effective. Test data, correlated over a sequence of tests, permits fixing of the core problem, rather than manifestation of the problem.

The sixth annual symposium is scheduled for May 16-17-18, 1989. The theme will be "The Program Manager--Present Challenges, Future Opportunities." New Administration changes, and the Defense Acquisition core will be addressed. More information will be available in Program Manager in early 1989.



Ms. Lentz is a marketing representative, Systems Integration Division, IBM, Gaithersburg, Md., and is secretary of the DSMC Alumni Association Board of Directors.



SEND US YOUR ARTICLES

Some Tips for Authors

The editors of *Program Manager*, DSMC's bimonthly journal, are interested in your thoughts on policies, processes, trends, and events in the areas of program management and defense acquisition. We invite you to submit articles and share your experiences. We are interested in lessons you have learned through your acquisition experiences, both successful and otherwise.

Beyond the demand for good grammar, we have some tips for prospective authors. Consistency and uniformity should be uppermost. The renowned stylist William Strunk, Jr., said, "If those who have studied the art of writing are in accord on any one point, it is this: the surest way to arouse and hold the attention of the reader is by being specific, definite and concrete."

Style

Write in the first person, *I, we, our*; and use *you* often. Active verbs are best. Write naturally and avoid stiltedness. Except for a change of pace, keep most sentences to 25 words or less, and paragraphs to six sentences. We reserve the right to edit for clarity and space limitations.

Published articles will include your byline, and a brief biography. When there are substantial editorial changes, *Program Manager* clears edited copy with the author.

Where possible, clear articles through your public affairs office or an equivalent authority. Most of the articles we publish are routinely reviewed and cleared by the Director, Security Review, Office of the Assistant Secretary of Defense for Public Affairs. All manuscripts are reviewed by DSMC faculty members with expertise in the subject matter. The receipt of your manuscript will be acknowledged within five working days. If we cannot print your article, you will be informed within six weeks.

Length and Graphics

The Basics: Double-space your article using only one side of the paper. One double-spaced page, with a one-inch border on all sides, equals about 250-300 words. We are flexible regarding length, but prefer 2,000-3,000 words, about 10 double-spaced pages. Don't feel constrained by length requirements; say what you have to say in the most direct way, regardless of length.

We use figures, charts, and photographs. Color is acceptable but we prefer glossy, black and white photographs, five-by-seven or eight-by-ten. We cannot guarantee the return of photographs. Include brief, numbered cutlines keyed to the photographs. Place a corresponding number on lower left corner, reverse side of the photographs. With this exception, do not write on photographs. Photocopies of photographs are not acceptable. Charts and figures should be sharp and clear, with legible information and captions. We prefer camera-ready art, but the DSMC Graphic Arts and Photography Division can work with sketches if they are clear and precise. If you know of sources where we can obtain photographs pertinent to your manuscript, let us know; i.e., program office, contractor, public affairs office.

Attribute all references you have used in researching your article. We use separate footnotes, which should be identified at the appropriate place in the copy.

Be wary of using copyrighted material. It is generally felt that Section 107 of title 17, United States Code, "Limitations on Exclusive Rights: Fair Use," clears the way for quoting short passages of copyrighted material in a scholarly or technical article to illustrate or clarify the author's observations. It also permits summarizing copyrighted addresses and articles with brief quotations. Lengthy use of copyrighted material requires written permission from the copyright holder. Likewise, if you are the copyright holder, your cover letter should explicitly state that the Defense Systems Management College has permission to publish your material in *Program Manager*.

Stories that appeal to our readers, who are senior military and civilian people in the program management/acquisition business, are those taken from *your own* experience rather than pages of "researched information."

Again, be sure to double-space your copy and use only one side of the paper. We appreciate your readership, and interest in *Program Manager*.

If you need to talk to an editor, call:

Robert W. Ball, (703) 664-5974 or 664-5082; Autovon 354-5974 or 354-5082.

Catherine M. Clark or Esther M. Farria, (703) 664-5992 or 664-5082; Autovon 354-5992 or 354-5082.

Or, write us at the Defense Systems Management College, Fort Belvoir, Virginia 22060-5426: ATTN: DRI-P.

PROGRAM *manager*

SECOND CLASS MAIL
POSTAGE AND FEES PAID
DEPARTMENT OF THE ARMY
ISSN 0199-7114

DEPARTMENT OF DEFENSE

**DEFENSE SYSTEMS MANAGEMENT COLLEGE
FORT BELVOIR, VIRGINIA 22060-5426**

**OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE \$300**

U. S. GPO: 1988-201-450/80005